THE IRON TRADE REVIEW

VOLUME XXVIII. CLEVELAND, O. AUGUST 29, 1895. CHICAGO, ILL. NUMBER 35.

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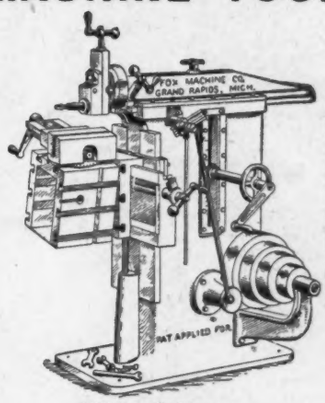

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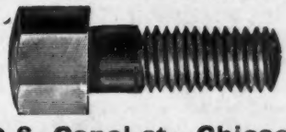

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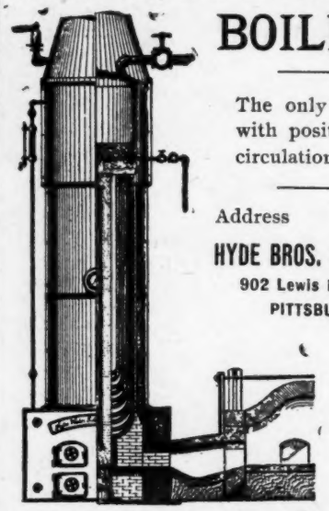

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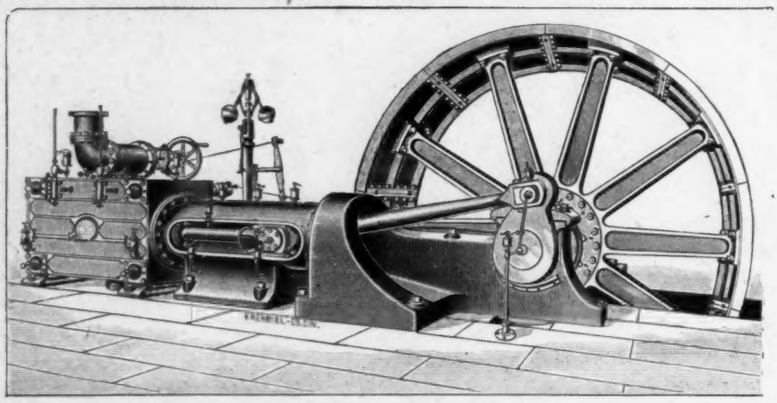

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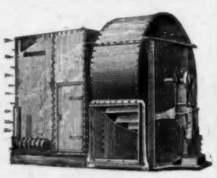

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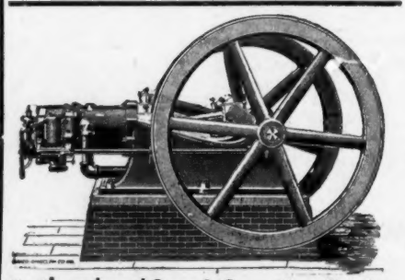

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THE IRON TRADE REVIEW

VOLUME XXVIII. CLEVELAND, O. AUGUST 29, 1895. CHICAGO, ILL. NUMBER 35.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Perhaps no week since the beginning of the revival in iron five months ago has developed so much of sensational import to the trade as the one under review. From $14 to $15.50 in the valley is the advance in Bessemer iron, and the scarcity of that metal for delivery in the balance of the year is the fact on which the attention of the whole steel interest of the country is now concentrated. The leading producers of steel in the West and in the Pittsburg district have been taking large blocks of metal, and on the heels of a brief period of quietness and of nearly stationary values, have brought the market to a point at which the cool heads in the business would fain pause to get their bearings. The week is of special significance for having brought Bessemer iron to a point at which the price of the domestic product is from 25 to 50 cents higher in the East than foreign hematites ex ship, Atlantic port. To be sure, hematite warrant stocks abroad are not heavy—about 110,000 tons in early August—and the sale of English Bessemer pig for shipment to the United States would soon advance the price abroad; yet on the present basis there is a chance for importations, and this fact is to be taken into account in connection with the predictions that seem to be in favor in certain quarters as to the price that will be reached in the next month or two. The probability of materially increasing the Bessemer output in the next four months seems slight, in view of the number of furnaces in the Central West that will be off through the fall for re-lining. One or two furnaces in the same section, now on foundry iron, will go to Bessemer, and in the East, Sparrow's Point will start in the late fall, on Cuban and African ores. Practically the Bessemer iron that will be sold hereafter for 1895 delivery will be confined to that secured from second hands and to amounts furnaces may be able to produce in excess of their estimates. While foundry iron is sure to share in a measure in the upward movement, there has been no clearly defined change the past week, except that quotations are stronger. August business with foundry furnaces has been comparatively quiet, but there are symptoms of a new buying campaign. The Southern situation is stronger and another general advance of 50 cents is looked for in early fall. The 20-cent freight advance to Ohio river points, announced for Sept. 2, was withdrawn, but it is intimated that a larger increase is being arranged among the railroads meantime. Forge iron, Northern and Southern, has been more active than foundry the past week. Late sales have been at $11.75 valley furnace. The week has seen an active market in soft steel, and more Western billets have come into the Cleveland district, one 10,000 ton transaction being closed. A number of inquiries are made for the first quarter of 1896. At Pittsburg 1895 business has been done at from $22 to $23, Wheeling district mill, the higher prices being secured on later deliveries. In the Cleveland district $23 steel has been sold, and in the past two days a mill has quoted $24, Cleveland, on deliveries into 1896. The enormous tonnage of finished material going out of iron and steel mills keeps up without interruption, and it is the purchases of raw materials to cover sales actually made in finished lines that have given the former their conspicuous strength. The railroads are more in evidence as buyers and recent Western sales both of rails and of bars are the beginnings of buying which is expected to grow as the time for the crop movement comes nearer. There are evidences of lighter current buying in some finished lines—plates, structural steel and bars for example—than in the early summer months, and while prices have not yielded a particle, some sellers advancing quotations because of higher raw material costs, there are here and there demurrers from buyers of finished products and a disposition to wait.

THE CLEVELAND DISTRICT.

The beginning of the fall grain movement from Duluth at a 3-cent rate brought ore freights to $1 from that port the past week, and Two Harbors has shared in the advance, though Ashland shippers have not yet paid the new rate. Escanaba tonnage is now 60 cents. The prospect of a resumption of shipments from Marquette seems more immediate in view of the reported willingness of steam shovel men to resume, but something depends on the attitude of the strikers. Their struggle is now exhibiting all the phases of defeat. Several hundred men have moved out of the district and many who remain are only hold in line by fear of the union lash. It is only a question of how soon the break will come. The possibilities of an ore shortage are not such, today, as to enter to any extent into the calculations of furnacemen. If the strike should continue to Sept. 15, with no movement from stockpiles meantime, it might be considered that the time had arrived to make a careful computation of the needs of furnacemen and the probability of meeting them. Inquiries for ore continue and sales are being made weekly, particularly of non-Bessemers. Mesabi Bessemers are moving and the sale would be larger were buyers able to get other ores to complete their mixture.

Pig Iron. The advances in Bessemer pig iron the past week have been a matter of almost daily record and the market is in an excited condition that has resulted in mingling facts and predictions rather indiscriminately. Sales of several 5,000-ton blocks of iron were made in the middle of last week at $14.50 in the valley; in two days $15.25 at valley furnace was done; early this week $15.50, and there are deals pending which involve figures from 50 cents to 75 cents higher. The steel companies of the West and Central West have been in the market, and in spite of the heavy buying and the shortness of the supply there is considerable metal yet wanted for 1895 delivery. The market today is $16 to $16.25 in the valley. One sale of the early portion of the week, deliveries extending in '96, was on a basis of $15.75 Cleveland. The probablity that one or two Western Pennsylvania furnaces will soon change from foundry to Bessemer would be more of an element in the Central Western situation were it not that two Edgar Thomson furnaces, Franklin at Columbus, and a Shenango valley stack will be out for relining. Foundry iron has not moved up, though it is reported

Continued on page 7.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

While the general market was rather quiet last week, several branches of the trade showed improvement, and the total of sales were good in nearly every class of iron and steel. The upward tendency of prices is still noticeable, and advances were made on billets. Several large orders of soft steel were closed last week, aggregating about 23,000 tons of billets and rods. Good sales of rails were also made. Pig iron was not in quite such large demand, but sales were very satisfactory. Bars sold well. Railroads have commenced to buy in fairly large quantities. A large contract for bridge material was placed in the West and several other orders of structural shapes were placed and are pending.

PIG IRON.—The inquiry has fallen off a little in the past week, and sales were not quite so large. Local iron is not being pushed by the furnaces at all, but notwithstanding this fact sales are being made all the time that equal the capacity of the furnaces running on foundry iron. It is expected that there will be a much heavier demand for iron by the middle of next month. Southern iron is selling fairly well, considering the fact that the furnaces are none of them anxious for any large amount of business, and some of them are entirely out of the market. Quotations are very firm, and there is a strong probability that they will be advanced within the next few weeks. There has not been so much talk of advances in Southern freight rates, but it is confidently expected that they will be made within a few weeks. Lake Superior charcoal is selling well, and several orders for large amounts were closed last week. Quotations are now made as follows:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$12 25@12 50
Local Coke Fdy. No. 1	00 00@14 00	South'n Silveries No. 1.	14 00@14 50
Local Coke Fdy. No. 2	00 00@13 50	South'n Silveries No. 2.	13 50@14 00
Local Coke Fdy. No. 3	00 00@13 00	Jackson Co. Silveries	15 50@16 00
Local Scotch Fdy. No. 1.	13 50@14 00	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2.	13 00@13 50	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	12 50@13 00	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 2	12 50@12 75	Alabama Car Wheel	17 00@17 50
South'n Coke No. 3	12 25@12 50	Malleable Bessemer	14 50@15 00
Southern No. 1 Soft	12 50@12 75	Coke Bessemer	14 50@15 00

BARS.—The railroads are reported as being in the market for large lots of bar iron, and one Southwestern road, which has held back from heavy purchases of material up to this time, has placed an order for a round lot. General business keeps up well, but nearly all sales are for small lots. Prices are unchanged, as follows: Common iron 1.40c to 1.45c; guaranteed iron, 1.50c to 1.55c; soft steel bars from strictly billet stock, 1.55c to 1.60c.

BILLETS AND RODS.—The billet market has been very active, and sales of over 20,000 tons were made by the local company. The price has been advanced to $24 to $24.50. Rods were also in good demand, and sales of over 2,000 tons were made, at $31 to $32.

RAILS AND TRACK SUPPLIES.—Sales of rails were rather lighter than usual last week, the total being not over 3,000 tons. Quotations are unchanged: Rails, $25 to $27; splice bars, 1.50c to 1.55c; track bolts, 2.35c to 2.45c; spikes, 1.95c to 2c.

STRUCTURAL MATERIAL.—A large business is in sight, both for bridge and structural shapes, and new contracts are coming up every day. Last week the contract was placed with an Eastern company for the Rock Island bridge, calling for over 4,000 tons, and several other large bridge contracts were given out. Specifications were sent in for the material required for the Davies building, to be erected in Chicago. Quotations are as last reported, and are very firm. Beams and channels, 1.90c to 2c; angles, 1.85c to 1.90c; plates, 2c to 2.10c; tees, 2c to 2.10c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—The inquiry has fallen off a little, but still good sales have been made. Quotations are as follows: Tank steel, 2c to 2.10c; flange steel, 2.25c to 2.40c; fire-box steel, 2.85c to 5c.; boiler tubes, 60 to 65 per cent discount.

MERCHANT STEEL.—The demand is quite large, but sales are only made in comparatively small lots. Quotations are unchanged. Open-hearth spring, tire and machinery steel, 2.10c to 2.20c; smooth finished machinery steel, 1.85c to 1.90c; smooth finished tire, 1.80c to 1.85c; Bessemer bars, 1.55c to 1.60c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SHEETS.—The market shows an excellent demand, and larger sales would be made if the mills were in shape to accept orders for immediate shipment. Few of them can do this. Quotations are made at 2.85c to 2.90c for No. 27 common iron, sheet steel is quoted at 2.95c to 3c; galvanized sheets, 72½ to 70 per cent discount.

OLD RAILS AND WHEELS.—A few sales of old iron rails are reported, at $15.50 to $16, Chicago. Old steel rails are in light demand, and are held at $11 to $12.50, according to length, etc. Old car wheels are quiet and are quoted at $11.50 to $12.

SCRAP.—The market is rather weak, and buyers are not anxious to make heavy purchases. Prices are made as follows: Railroad forge, $12.50 to $13; dealer's forge, $10 50 to $11; No. 1 mill, $8 to $8.50; heavy cast, $8 to $8.25; axles, $16 to $16.50; cast borings, $5 to $5.25; wrought turnings, $6.25 to $6.50; axle turnings, $7.50; mixed steel, $8 75 to 9; stove plates, $6; heavy melting steel, $11 to $12.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The week has been the most exciting since the upward march in prices began. Bessemer pig has jumped $1.50 and steel billets are quoted at $1 to $2, advance over figures accepted a week ago. The shortage in Bessemer pig that has been discussed for some time as a probability has become a very palpable fact. The leading Western producer of steel has been buying all the metal it could get in the past 10 days, and when its purchases had reached 50,000 tons and other steel companies came into the market the scarcity of Bessemer metal for delivery before Jan. 1 caused a sudden rise, and under the buying that followed the price quickly went to $15.50 valley furnace, with that figure now being refused by the few middlemen and furnaces having iron to sell. Some little business for the first quarter of 1896 has been done, but few furnaces are willing to accept the offers of $15.75 and $16 in the valley made in this connection. The feeling is feverish and further advances are now confidently looked for. The purchases of the week are said to be to cover actual business taken by the steel companies, and the beginning of liberal buying by railroads is a prime cause of the advance. The Bessemer transactions of the week in the valleys and Pittsburg have amounted to upwards of 60,000 tons, some of the metal being purchased from second hands, and the prices have ranged from $14 to $15.50 at valley furnace, considerable business being done at $15.25. Foundry irons have also felt the influence of these transactions and are higher. No. 1 sells readily at $13.75 to $14, and No. 2 at $13 for all ore. Gray forge is now quoted at $12.25 to $12.50. A sale of 1,000 tons was made several days ago at $12.15. The steel mills are well sold up and the Pittsburg trans-

actions are through brokers. Sales are reported at $22 and $22.25 in the Wheeling district, the last named being for August shipment. A sale of 1,000 tons, September, was made at $22.75 Pittsburg, but $23.50 is the minimum of the few sellers who can deliver billets in the next four months. Plates have again advanced and only here and there is 1.85c, a possibility on tank steel, the range being from that figure to 2c. Flange is quoted at 2.05c to 2.20c. In beams and channels the volume of new contracts closed is steadily maintained, but no large sales are reported recently. The range is 1.65c to 1.75c below 15-inch, with higher prices on prompt small-lot shipments. Bars are in increasing demand, chiefly on railroad account, and prices are firm at 1.30c to 1.35c. Steel bars are 1.35c to 1.40c. Manufacturers of merchant steel have had representatives here this week. Some time ago they formed an association to secure uniformity of action. A later meeting will be held. The market for iron and steel skelp and for pipes and tubes is stationary. Prices are firm. Muck bar has sold at $22.25. Old material sells sparingly on account of the diverse ideas of buyers and sellers, at $14 for No. 1 railroad wrought scrap, $18 for old iron rails, $15 for old steel rails. There is some talk of higher coke in September, but furnaces are little concerned, nearly all having covered for the rest of the year at $1.25 or less. The Connellsville production has been stationary of late, being 153,238 tons for the week ending Aug. 17. Shipments were 8,287 cars.

Cincinnati. The week has been a repetition of the one preceding. A fair volume of new business has been transacted at full prices and a much larger tonnage has gone forward on existing contracts. At Southern furnaces the scarcity of Soft and Silvery grades continues and consumers are greatly inconvenienced in consequence. The only advances reported are in Bessemer and Northern forge irons. Bessemer sold on the 23d at $14.50 cash, valley furnace, and the situation there is reported as very encouraging. Considerable attention is now given to the Pocahontas coke district. The strike is practically at an end although the defeated agitators are still in the field. Probably not more than 25 per cent of the ovens are in operation and the remainder will be fired only when new contracts can be secured at a stiff advance over prices prevailing prior to the strike. Operators claim to have lost money on the old basis and they now intend to get profitable figures or remain idle. It is claimed that some contracts have been placed recently at $1.60 to $1.75 and many predict that $2 will be reached by the first of the year. At present skilled labor is scarce, many of the old men having left the district. There have been rumors of several Virginia blast furnaces resuming operations, that have been long idle, and as these will be obliged to draw their coke supply from the Pocahontas district, it will necessitate their paying a high price for fuel and it is doubtful whether they can operate at a profit. From Alabama it is reported that corrected figures show the reduction of stocks there to be about 13,000 tons in excess of the published statistics. This would make the July decrease in stocks of coke iron about 57,000 tons.

Buffalo. Proprietors of manufacturing plants are returning from summer vacations and are looking into the question of pig iron supply with more interest than they exhibited early in the summer. Sales have not been numerous, but melting is heavy and a great many concerns must place further contracts before the close of the year. Rumors continue to be heard of further advances in pig iron, but beyond a stiffening in Bessemer pig and steel billets, there are no changes in values worthy of note. Certain grades of Southern softeners which have been in regular use in this market for years are becoming so scarce as to cause inconvenience.

ELECTRIC HAULAGE IN MARQUETTE MINES.

J. Parke Channing, M. E., well known in the Lake Superior iron ore region, having had charge of operations at one or two properties, and for two and a half years acting as mine inspector on the Gogebic range, contributes an article on "Lake Superior Iron Ore" to the 1894 volume of "The Mineral Industry" which has just come from the press. We reproduce below the description of the electric haulage systems now in use at the Lake Angeline West End mine and the Lake mine of the Cleveland-Cliffs Co., both in the Ishpeming district:

Some two years ago electric tramming was introduced at the Angeline and the management seem well satisfied with it. The generating plant is in the engine house on the surface, along with the hoisting engine and air compressor, and is attended by the one engineer in the room. Brakemen are there of course to run the drums. The engine is a 14x30 in. Reynolds-Corliss and by belt runs a T.-H. shunt-wound motor. The voltage is 550, revolutions per minute 900, winding and wiring for a 10% loss. Two motors are in the mine, one a spare. They are the iron-clad, water-proof turtle-backs, and handle six cars carrying 2½ tons each. With this load about 30 to 40 amperes of current are used. No particular novelty is shown in the construction of the trolley line save that the wire, No. 0, is covered by a 12-in. tarred board with strips on its edge. This is fastened to the under side of the caps and protects the wire from dripping water. The rails are bonded in the usual way and connected with a No. 0 ground wire. The trolley is of the diamond pattern. Two men are employed, a motorman and a switchman. The motor runs out with a trip of five or six cars and spots them in one drift of the mine, then runs to another drift and collects a trip of cars that have been filled at the chutes and leaves them at the shaft. This process is repeated at all the various parts of the level. Between times a trip of flat cars loaded with timber is taken out and left under the various raises to be unloaded.

The cost of tramming the ore is 2c a ton, the cost of loading the ore from the chutes into the cars, and from the cars at the shaft into the skip, is 3c, so that the total cost of handling ore and timber from chute to skip is 5c per ton. If this were done by hand it would probably cost at least 12c per ton. The product handled is about 15,000 tons a month. When the plant was first installed, one or two miners carrying drills on their shoulders were shocked by allowing the drills to touch the trolley wire, and a few inquisitive people tried the experiment of touching the live trolley wire with their iron candlesticks. No serious harm was done any one, but care is now taken to avoid contact.

The tramming at the Lake mine [Cleveland-Cliffs Co.] is now done by an electric plant similar in plan to that at the Angeline. The ore cars, however, are of a new construction for the district. They are of steel, quite high, and carry 3½ gross tons of ore. Instead of being end-dumpers, the bottom is provided with doors, and at the shaft the cars are slowly shunted along at right angles to the line of the main inclined hoisting shaft and dumped into an underground pocket. From the pocket, by means of a suitable loading shute and door, the skips are quickly loaded. The hoisting engine at this shaft is the only cross-compound first-motion plant on the lake. It winds with a 10-ft. drum, two skips in balance. The drum is made in halves, one of which is keyed to the shaft. The other half is loose on the shaft but boited near the rim to the keyed half. This permits of a relative adjustment of the two hoisting ropes and obviates the necessity of two clutches and their usual mechanism. It, however, necessitates the empty skip going to the bottom each time. No gates are used for the skips to rest on, as they hang by the rope in the shaft. To give the engineer control in this particular, an indicator has been put in, where a long pointer swings over an arc to indicate the position of the skip, not only as it comes into the dump but also at each level. The indicator mechanism is also connected with a device to prevent over-winding.

THE IRON TRADE REVIEW

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AUGUST 29, 1895.

WILL FOREIGN IRON COME IN?

The Bessemer pig and billet markets in the Central West have shown more feverishness in the past week than has developed in any equal period since the upward movement began. Bessemer iron doubtless will have passed $16.50 Pittsburg by the time this is read, with steel at $23.50 to $24. The former sold at $9.75 Pittsburg, the first week in January and the latter at $14.75, making an advance of $6.75 for iron and $8.75 for steel in eight months. The pace is a rapid one, and already has given rise to questioning. It has been said all along that no boom was wanted in the iron trade, and, whatever the desire of the factor in the business that limits itself to buying and selling, producers have been a unit in the belief that holding a moderate advance is better than rapidly rising prices for a short period, with the probability of a sharp reaction afterward. The advances of the past 10 days in Bessemer pig and billets, coming after three or four weeks of nearly stationary prices have prompted the question whether the boom which the iron trade has been continually assuring itself would not come, is really being averted.

Bessemer pig at $16.50 Pittsburg, means that the highest price of 1891 has been reached and that the highest price of 1892, which was in January of that year, namely $15.75, has been exceeded by 75 cents. We know there are those who are now predicting that Bessemer iron will yet go $2 to $3 higher and who figure that there can be no importations of any moment below that basis; but the fact is that the importing point has been reached already. In the table below, showing the prices of English iron and steel on board ship on the other side, the price delivered at Atlantic port and the corresponding price of domestic material, we give latest foreign quotations on hematite warrants, Gartsherrie iron, Cleveland forge, and Bessemer steel:

	Price abroad Aug. 20.	Duty.	Freight.	Price Atlantic port.	Price Domestic Phila.
Bessemer Pig.....	$11 25	$4	$1 50	$16 75	$17 50 to $18
Gray Forge Pig.....	8 45	4	1 50	13 95	12 75
No. 1 Foundry.....	12 40	4	1 50	17 90	14 00
Bessemer Billets.....	19 00	6 72	1 50	27 47	$24 to $25

While the margin noted above in the case of Bessemer pig is not sufficient to pay freight to a mill situated more than a few miles from the seaboard, it is evident that any considerable advance on present prices would afford leeway for an incoming movement of Bessemer metal. The fact that stocks abroad are not large and that the purchase of several blocks of metal for shipment to the United States would send up the price at English ports is to be considered; but on the other hand there are idle Middlesbrough furnaces that would welcome the chance to go in blast on the prospect of six months profitable shipment to the United States.

We realize perfectly well that nothing that is said on this subject can change the situation as it exists. There are producers of iron who recognize that the danger line has been reached, but in the market their policy undoubtedly is to get the highest price their product will bring, and we do not find anybody seriously making any effort to avoid a boom. Nevertheless there are possibilities of harm from speculative influences at times like the present and certainly the entire trade is interested in seeing these reduced to the minimum.

It is to be remembered, too, in connection with any import movement of iron and steel, that to free the home maaket of the product of a foreign seller is far less easy than to open the gates in the first instance. The movement of foreign material this way lasted for several years after the boom of 1879 that furnished the start. In finished material, particularly in beams and channels, angles, tees and plates, the present basis is close to the entering point for Belgian products, if it has not already passed that point; and further advances in raw material, if followed by corresponding advances in mill products, might easily result in considerable importations.

STEEL MANUFACTURERS AND SHIPPING.

We have from *Seaboard* an advance proof of an editorial on "Steel Manufacturers and Shipping," prepared for its issue of Aug. 29, with a request for our comment on it. The article calls attention to the interest of American steel manufacturers in the rehabilitation of American shipping. The possibility of Japanese ships of war being built in American shipyards, the order of the Russian government for Bethlehem armor plate, the petition of Chas. H. Cramp to the British admiralty for permission to bid on British war ships, and the placing of an order by Russia with a lake shipbuilding company for the construction of three ice-crusher car ferry boats, are cited as evidence that the American shipbuilding industry is filling a larger place than ever before. Attention is directed to the fact that last year we built 16,000 tons of ships for the foreign trade and Great Britain over a million tons, and with the attractive prospect of $300,000,000 worth of vessels that would be built in American shipyards, if all the foreign registered vessels now engaged in American-foreign commerce were replaced with American vessels, steel manufacturers are urged by our contemporary to "take some positive affirmative action looking to the restoration of American shipping to the foreign carrying trade."

American steel manufacturers scarcely need any urging to favor any policy that will add materially to the home consumption of their product. We question whether united aggressive action by steel manufacturers would do a tithe of the good that would come from action by such a body as the National Association of Manufacturers, that is to meet in Chicago in a few weeks. The steel manufacturers wanted a fair measure of protection for their products, and it will be agreed, we think, that they were well provided with organization looking to that end. But the majority of the House committee that heard their representatives at Washington in 1893 voted directly against what had been asked.

The value to the United States of a national policy that will build up a merchant marine and fill American shipyards with work and American steel works with contracts for marine material, needs to be appreciated by broad men of commercial standing and influence, who have

nothing to do directly with shipyards or steel works. The truth needs to filter into the minds of our Representatives at Washington that the maintenance of a great industry like that of the Cramps at Philadelphia is a matter of National concern. Under the system of American registry for ships owned by Americans, no matter where built, which is seriously urged by some, there would never have been such a shipyard as the Cramps'.

Manufacturers of every description of product that seeks a market abroad have a large stake in this question. And the only effective and practical method of showing their interest is to work for a system of subsidies for American shipping.

We are aware of the prejudice against bounties and subsidies, and of the opposition of many strong protectionists to the sugar subsidy, because on principle they opposed that method of encouraging industry. But the problem is a very practical one and must be handled in the most practically effective method. With a handicap of 20 to 30 per cent increased cost on vessels built in the United States there is no such thing as the profitable sailing of American built vessels in competition with those built on the Clyde. England's example in this matter is worthy of imitation. For 40 years it paid over $6,000,000 each year in subsidies to establish communication with India, Australia, Canada and South America, and is paying to-day several million dollars a year to maintain this important service. Subsidies have been granted by tens of millions to make our railroads foremost among internal transportation systems of the world. Why draw the line against this time-tried method of building up profitable commerce under our own flag, with our neighbors in South America?

The National Association of Manufacturers, with its subsidiary State organizations, reaches into every section of the country and its influence can be powerfully exerted in the solution of this problem that to-day stands in the way of the development of a foreign trade in American products on any permanently satisfactory or profitable basis.

IRON and steel imports to the United States in the fiscal years ending June 30, 1895 and 1894, are shown in the following statement:

	Gross tons 1895.	Gross tons 1894.
Pig iron	14,174	25,763
Scrap iron and scrap steel	2,882	2,822
Bar iron	12,926	10,162
Iron and steel rails	784	2,178
Cotton ties, hoops, etc.	5	800
Hoop, band or scroll	173	994
Steel ingots, billets, blooms	13,441	12,447
Sheet plate, and taggers	25,130	27,019
Tinplates	226,977	202,7.0
Wire rods, iron or steel	22, 51	25,102
Wire and wire rope	5,992	3,889
Anvils	484	328
Chains	427	206
Total	325,946	314,460

There was an increase shipment of iron ore into the United States in the past year, the total being 262,703 tons against 218,550. Almost all of this was Cuban ore or the manganiferous and manganese ores used about Pittsburg and at Johnstown in making spiegeleisen and ferromanganese. Foreign low phosphorus ores cut an exceedingly small figure.

THE CLEVELAND DISTRICT.—Continued from Page 3

firmer, with sales of No. 1 at $13 and of No. 2 at $12.50 in the valley. Scotch irons have sold at $13.50 and $13 respectively. We note sales of gray forge at $11.75 in the valley, with increased activity in this iron, both Northern and Southern. Lake Superior charcoal is firmer. One large producer has withdrawn from the market for the present. Late sales range from $13.50 to $14, Lake Erie port.

Finished Material.

Locally there has been a light demand the past week in bars, structural material and plates, but any changes in prices are to a higher basis. One important producer has advanced quotations 1-10c on structural shapes and bars, in view of the advances in raw material. Plates are firmer and for tank the range is 1.85c to 1.95c, Pittsburg. Railroad inquiry is noted, simultaneously with the beginning of the grain movement and considerable purchases on car account are likely to be made early in September. There are signs that some buyers of finished material are holding off in view of high quotations lately made. The amount of iron being rolled seems steadily on the increase. Skelp is in demand much beyond the capacity of mills to supply. In steel, the market has shifted rapidly to higher ground. Billets from a Western mill have been sold in Cleveland at a figure reported to be in the neighborhood of $23. Steel in second hands has been offered at $24, Cleveland, and it is reported that that price has been paid. The advance in rods is even more rapid. The last reported sale was at $30 and the quotation is now $32.50.

A Nut and Bolt Meeting.

The nut and bolt manufacturers of the country are holding a meeting at the Fifth Avenue Hotel, New York, this week. The railroad demand has begun to be felt by these companies lately and orders from that source are steadily on the increase. The carriage trade meantime has shown a marked increase in its purchases over last year, and some of the nut and bolt works are filled up for several months ahead on this class of work. It is considered that the time has come for nuts and bolts to participate to a greater extent in the advances that are being made in other lines.

The Mineral Industry in 1894.

THE MINERAL INDUSTRY; ITS STATISTICS, TECHNOLOGY AND TRADE IN THE UNITED STATES AND OTHER COUNTRIES, TO THE END OF 1894. Vol. 3. Edited by Richard P. Rothwell, editor of the *Engineering and Mining Journal*, New York. The Scientific Publishing Co., 1895. Price $5.

It is not necessary to dwell at length on the scope of this valuable work, in view of what has been said in connection with the appearance of Vol. 1 in 1893, and of Vol. 2 last year. These annual octavo publications are the development of the statistical number formerly published annually by the *Engineering and Mining Journal*, covering the statistics of the mineral industry in the United States and other countries in the year preceding. The volume before us contains upwards of 750 pages, bringing up to Jan. 1, 1895, the statistics of production of the metallic and non-metallic minerals, with elaborate articles on the technical and commercial developments of the year 1894 in all lines of production. A number of well known names, home and foreign, appear in the list of contributors, and rather more has been made than in the other two volumes, of new processes and of other technical changes of the year. The volume is of great value, not only to the mining engineer and the student, but to all commercially interested in the industries covered. The article on "Iron and Steel" is by Frederick Hobart, and that on "Lake Superior Iron Ore," by J. Parke Channing.

THERE are further mutterings of discontent among Mahoning valley puddlers, and a meeting was held Saturday night, Aug. 24, at Youngstown, attended by President Garland, of the Amalgamated Association. The puddlers present asked many questions concerning the puddling scale and there was sharp discussion that lasted to midnight. A bitter feeling seems to prevail among some of the puddlers who insist on higher wages without waiting for the 60-day averages provided for in the scale. Some of the leaders in the movement are making severe comments on President Garland's course and threaten to withhold the dues of puddlers' lodges from the Amalgamated Association, while here and there the revival of the Sons of Vulcan is agitated.

MANUFACTURERS' SPECIFICATIONS FOR STRUCTURAL STEEL.

Below are given the manufacturers' standard specifications, governing the physical properties of structural steel, as adopted at the meeting of the Association of American Steel Manufacturers at Atlantic City, Aug. 9. The signatures of all the steel manufacturers of the country will have been secured to the new specifications by the end of the present week and they will become operative Sept. 1:

PROCESS OF MANUFACTURE.

(1) Steel may be made by either the Open Hearth or Bessemer process.

TEST PIECES.

(2) All tests and inspection shall be made at place of manufacture prior to shipment.

(3) The tensile strength, limit of elasticity and ductility shall be determined from a standard test piece cut from the finished material and planed, milled and turned parallel. The elongation shall be measured on an original length of eight inches, except when the thickness of the finished material is 5-16 inch or less, in which case the elongation shall be measured in a length equal to sixteen times the thickness; and except in rounds of ⅝ inch or less in diameter, in which case the elongation shall be measured in a length equal to eight times the diameter of section tested. Two test pieces shall be taken from each melt or blow of finished material; one for tension and one for bending.

(3-a) Material which is to be used without annealing or further treatment is to be tested in the condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the specimen representing such material is to be similarly treated before testing.

(4) Every finished piece of steel shall be stamped with the blow or melt number; and steel for pins shall have the blow or melt number stamped on the ends. Rivet and lacing steel, and small pieces for pin plates and stiffeners, may be shipped in bundles securely wired together, with the blow or melt number on a metal tag attached.

FINISH.

(5) Finished bars must be free from injurious seams, flaws or cracks, and have a workmanlike finish.

GRADE OF STEEL.

(6) Steel shall be of three grades—Rivet, Soft and Medium.

(7) *Rivet Steel.*—Ultimate strength—48,000 to 58,000 lbs. per sq. in. Elastic limit—Not less than ½ the ultimate. Elongation—26 per cent. Bending test—180 degrees flat on itself without fracture on outside of bent portion.

(8) *Soft Steel.*—Ultimate strength—52,000 to 62,000 lbs. per sq. in. Elastic limit—Not less than ½ the ultimate. Elongation—25 per cent. Bending test—180 degrees flat on itself without fracture on outside of bent portion.

(9) *Medium Steel.*—Ultimate strength—60,000 to 70,000 lbs. per sq. in. Elastic limit—Not less than ½ the ultimate. Elongation—22 per cent. Bending test—180 degrees to a diameter equal to thickness of piece tested without fracture on outside of bent portion.

PIN STEEL.

(10) Pins made from either of the above mentioned grades of steel shall, on specimen test pieces cut at a depth of one inch from surface of finished material, fill the physical requirements of the grade of steel from which it is rolled for ultimate strength, elastic limit and bending; but the required elongation shall be increased by five per cent.

(11) Eye-bar material, 1½ inches and less in thickness, made of either of the above mentioned grades of steel, shall, on test pieces cut from finished material, fill the physical requirements of the grade of steel from which they are rolled. For thickness greater than 1½ inch there will be allowed a reduction in the percentage of elongation of one per cent for each one-eighth of an inch increase of thickness to a minimum of 20 per cent for medium steel and 22 per cent for soft steel.

FULL SIZE TEST OF EYE-BARS.

(12) Full size test of steel eye-bars shall be required to show not less than 10 per cent elongation in the body of the bar, and tensile strength not more than 5,000 pounds below the minimum tensile strength required in specimen tests of the grade of steel from which it is rolled.

The bars will be required to break in the body, but should a bar break in the head but develop 10 per cent elongation and the ultimate strength specified, it shall not be cause for rejection, provided not more than one-third of the total number of bars tested break in the head; otherwise the entire lot will be rejected.

VARIATION IN WEIGHT.

(13) The variation in cross section or weight of more than 2½ per cent from that specified will be sufficient cause for rejection, except in the case of sheared plates ordered to gauge, in which event there will be permitted an excess of weight over that corresponding to the dimensions on the order equal in amount to that specified in the following table:

TABLE OF ALLOWANCE FOR OVERWEIGHT FOR RECTANGULAR PLATES.

	Up to 75" wide.		75" to 100" wide.	
For plates ¼ inch thick	10	per cent.	14	per cent.
" " 3-16 " "	8	"	12	"
" " ⅜ " "	7	"	10	"
" " 7-16 " "	6	"	8	"
" " ½ " "	5	"	7	"
" " 9-16 " "	4½	"	6½	"
" " over ⅝" "	3½	"	5	"
" " ⅝ inch "	4	"	6	"

Specifications for Structural Cast Iron.

(1) Except where chilled iron is specified, all castings shall be tough gray iron, free from injurious cold-shuts or blow holes, true to pattern and of a workmanlike finish. Sample pieces one inch square, cast from the same heat of metal, in sand molds, shall be capable of sustaining on a clear span of four feet eight inches, a central load of 500 pounds when tested in the rough bar.

Alabama Iron for Open Hearth Steel.

Mr. J. Bowron, treasurer of the Tennessee Coal, Iron & Railroad Co., in a letter to the *Manufacturers' Record* in regard to making iron suitable for steel, says:

"We have known for the past three years that we could easily by the use of the Talbot process rapidly and efficiently desiliconize Birmingham iron, and have no doubt as to the entire efficacy of working this process on a large commercial scale. We have also known that we could make, and in fact have made to the extent of several thousand tons, iron which was low enough in silicon as it left the blast furnace to admit of its being worked in ordinary basic open-hearth furnaces. This iron was, however, made from selected brown hematite. Within the last three weeks we have put a furnace in this city on the production of basic pig from the ordinary current every-day run of ore received from Red Mountain, this being the standard and staple ore of the district. We have experienced no difficulty in running the furnace regularly on a product coming within the limits prescribed by the leading steel-makers of Pennsylvania. We are now making shipment of sample carloads, and are prepared to furnish the metal regularly to any who may desire it. This opens the way for the location of an ordinary open-hearth steel plant here."

THE 10 weeks strike of the wire drawers and nail makers at the HP Nail Works, Cleveland, was settled Aug. 27. At a conference a few days previous the company had offered the coarse wire drawers 12½ per cent advance. The basis of settlement was an advance of 10 per cent to the fine wire drawers and 15 per cent to the coarse wire drawers. The advances first asked by the men ranged from 22 to 25 per cent. The company yielded the 15 per cent finally asked by the coarse wire drawers on condition that the nail makers, who had asked a ten per cent advance be content with 5 per cent. To this the latter consented. The wage struggle at the HP Works differed from that in the American Wire Works, in involving an additional class of labor, namely, that of nail mills. There was this other difference too, that the American Wire Co.'s large conversion deal with the Illinois Steel Co. made the latter interested enough in the termination of the strike to amend its low-priced contract by taking care of the additional labor cost involved in the new rod mill scale.

WE are directly informed that the report is untrue, that the Jupiter Furnace Co. intends soon to put its furnace at South St. Louis in blast.

MACHINE SHOP AND FOUNDRY.

Cast Iron before the Iron and Steel Institute.—At the autumn meeting of the Iron and Steel Institute held at Birmingham, Eng., last week, beginning Aug. 20 and ending Aug. 23, three papers were presented from the United States: "Cooling Curves and Tests for Cast Iron," by W. J. Keep, Detroit; "Tests of the Physical Properties of Cast Iron," by Thos. D. West, and "The Hardening of Steel," by H. M. Howe, of Boston. Mr. Keep's paper reviews the work of the Committee on Uniform Standards in Tests and Methods of Testing Material, appointed by the American Society of Mechanical Engineers, and gives the substance of the papers on "Transverse Tests of Cast Iron" and "Keep's Cooling Curves" presented by Mr. Keep at the Detroit meeting of the A. S. M. E. The details of Mr. Keep's experiments for the registration of the behavior of a test bar while cooling from a liquid state to that of a cold bar, have already been given in these columns. The author, in his Birmingham paper, says: "The record of one size of test bar cannot be reduced to that of another size by any formula now in use, because any change in size will change the size of the grain and therefore the strength. Each mixture of iron and each percentage of silicon will produce the best results in one single size of casting, and not as good a resnlt in any other size. A formula that will apply to cast iron must be constructed from data given in this diagram, but it can then give only approximate results, because the same percentage of silicon will not give the same result in different iron mixtures. I am making experiments, which are nearly successful, which will allow the making of ½-inch square bars with the grain of a casting four inches square, in which case with these and the ordinary ½-inch bars in green sand, I shall have the record for each end of the curve, and by drawing the curve with a template which shall be standard, the strength of any size of casting can be determined graphically in terms of a ½-inch square bar, and the strength of the casting itself can then be determined correctly by the formula now used."

Mr. West discusses in his paper questions raised by his contributions to the proceedings of the Foundrymen's Association, of Philadelphia, and the Western Foundrymen's Association. He states them in this form: "First, should a standard system for testing possess means of recording the fluidity or the pouring temperature of molten metal at the moment test bars are poured? Second, should a test bar remain in contact with its chill until cold? Third, do not the elements which disqualify a test bar from truly recording the strength of an iron, make it unfit for recording the contraction? Fourth, what is the best size and form for a test bar, to most accurately record the physical properties of cast iron? Fifth, in what position should a test bar be cast, on end or flat?"

Mr. West presents his own answers to these questions and invites the criticism of the Institute, "to the end that truth may prevail and lead to the recognition of some one standard which can be adopted throughout the world to obtain accurate records of the physical qualities of cast iron."

* * *

Gradual Regeneration of Machine Shops.—Recently I came to a shop where there were evidences of springtime, writes James F. Hobart in the *American Machinist*. There seemed to be a general awakening. New machines were sprouting everywhere. Lots of old-time tools seemed to be badly winter-killed. The house-cleaning had also evidently been effected, and much of the old decay and old ruts were filled full of worthless matter, until they were trodden out of all recognition. There is hope for a shop when such a movement strikes it. A gradual regeneration is much better than a sudden one. Men as well as machines stand it better. Some large shops are suddenly put on to piecework at a given date. Many of the old machines have to be retired forthwith and quite a number of mechanics cannot stand the strain, and prefer to go with the old machines rather than start anew. In fact, it is too much like "teaching an old dog new tricks." By the gradual substitution process the same ends are attained, and there is not as much tearing up and replacing.

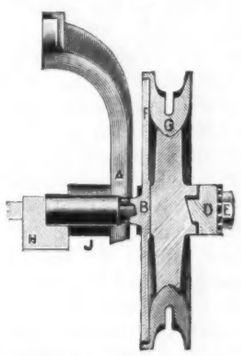
* * *

Elusiveness of Foundry Troubles.—A foundryman was telling me of a sad experience of his growing out of difficulties he had in making smooth castings. He first lay the blame on the workmen because they did not use the facings properly. The men grumbled and said they used them just the same as they always had. Of course they had not, so he tried it himself and got no better results. Then he went for the firm from which the facings were bought. They, in turn averred that the quality of the lot that he was using was up to the standard and that it was just the same as he had always been using. Their agent came to look over the matter and much to my friend's astonishment told him that probably he was using a bad mixture of iron that cut the facing. There was no sense in this, if the facings were first class, but just to prove that the man was in the wrong, the foundryman changed his mixture, and the smoothest kind of castings were the result. Chemistry is a mean thing for a novice to fool with.—[J. H. Allen in Dixie.

AUTOMATIC PULLEY BLOCK BRAKE.

A feature of Moore's anti-friction differential chain pulley block, which has been illustrated in these columns, is the automatic brake, shown in the accompanying sectional cut. A friction plate F of slightly less diameter than the hand wheel is mounted upon an extension of the hub of the hand wheel and between it and the block frame A. The friction plate has a wedging contact with the block frame at B and the hand wheel has a reverse wedging contact with the clutch D which is keyed to the shaft and held in position by the adjusting nut E.

A pull on the hand chain to raise the load loosens the wedge B and tightens the wedge D, while a pull on the hand chain to lower the load tightens the wedge B but loosens the wedge



D, one wedge counteracting the other and producing no friction between the plate and the frictional surface of the wheel at the point F.

When the hand wheel G is in a state of inertia, the pull of the load on the shaft tightens the wedge D, carrying with it the hand wheel and friction plate, tightening also the wedge B, and the two wedges acting together set the frictional surfaces into contact and effectually lock the block. A pull on the hand chain in either direction releases one of the wedges, but as soon as the pull ceases the load instantly catches up and locks both of them. The lock is positive and smooth working, since the friction surfaces are really never out of contact, and heavy loads may be lowered by a pull on the chain of a very few pounds. The adjusting nut is locked to the clutch by a small screw which passes between two of the projections of the nut. To make the block lower more freely this small screw may be taken out and the nut turned one or two notches to the left. To make it lower less freely the nut is turned one or two notches to the right, the locking screw being replaced. The friction surfaces are self-lubricating.

The manufacturers are the Moore Mfg. & Foundry Co., Milwaukee, Wis.

THE Chicago Shipbuilding Co. closed the contract for another large steel steamer last Monday, which gives the Calumet yards four vessels for construction this fall and winter, and fills their capacity. The new boat will be built for Capt. C. W. Elphicke and Arthur Orr, of Chicago, and M. M. Drake, of Buffalo, general manager of the Lackawanna Line. It will be 326 feet keel, 345 feet over all, 42 feet beam and 26½ feet deep. When the 20-foot channel is completed the steamer will belong to the 5,000-ton class.

LAKE SUPERIOR IRON MINES.

The Chandler is now raising from Shafts 2, 3 and 4 about 1,600 tons daily and is shipping 4,500 tons a day. About 350 men are employed, but this force will be reduced shortly to 200 men.

Work was resumed at the Commodore mine on the Mesabi last week. It is not expected that any considerable shipment will be made this year.

It is evident that the Lake Superior Consolidated Iron Mines will make large outputs in 1896 at its Lake Superior mine in the Hibbing district and at its Adams mine. For the former, four hoisting plants have been ordered recently and mining will be carried on from that number of shafts, which are now being sunk.

At Wakefield, on the Gogebic range, 150 men are at work at the Brotherton mine and 90 at the Sunday Lake.

There are indications that some shipments will be made from the stockpiles of the Florence mine, which contain 200,000 tons.

The loading of 113 cars in 13 hours with a steam shovel, at the Chapin mine, is a recent record-breaker there.

In its issue of Aug. 24, *Iron Ore*, of Ishpeming, Mich., has the following concerning the mines there and the status of the strike: To-day the water is rising in the Salisbury, Cleveland Lake, Lake Angeline East End and Old Mine, in the Lake Superior No. 7 and Hematite. In the Salisbury it has risen to a height of 110 feet, in the Lake Angeline about 100 feet. In the latter it will run to the Lake Superior Section 16 mine at the seventh level when the latter property will have to suspend as they will not be able to handle it. This incoming water is a serious thing for the business enterprises of this town. There is much talk to the effect that the companies cannot permit these mines to fill, but the fact remains that the mines are filling, and we know right well that they will be permitted to fill to their very mouths. It will take some time to unwater these shafts when work does resume. Some of the mines will do nothing in the way of producing ore until the winter, or until their present stockpiles have been disposed of. Work of removing these stockpiles will soon begin. If men to operate the shovels cannot be found here they will be obtained elsewhere and protection of ample kind will be afforded them. Many miners are leaving this section daily. For a time they were prevented from going away, but they are now permitted to do so undisturbed.

The wage scale which the Marquette mining companies are willing to pay and which the strikers rejected at their meeting last week, is as follows: Average for contract miners, $1.70 per day; company account miners, $1.60; underground laborers, $1.40; underground trammers, $1.40; pumpmen, $1.75; foreman of timbermen, $1.90; ordinary timbermen, $1.40; underground track foremen, $1.60; electric haulage motormen, $2.10; engineers, 12 hours, $1.70; firemen, 12 hours, 1.60; brakemen, 12 hours, $1.60; blacksmiths, $1.65 to $2.40; carpenters, $1.70; machinists, $1.90 to $2.50; foremen of timber-cutters, $1.50; ordinary timber cutters, $1.25; teamsters, $1.40; ore inspectors, $1.25; surface laborers, $1.25; surface trammers, 10 hours, $1.30; engineers of steam shovels, $2.65; cranemen on steam shovels, $2.20; firemen on steam shovels, $1.55; diamond drill runners, $1.75; diamond drill helpers, $1.75. The demand of the men is for the following scale of wages and the recognition of the union: Miners on contract, $2; underground labor, $1.75; surface labor, $1.50; engineers, $2.10; brakemen, $2.10; pumpmen, $2.10; firemen, $1.80; diamond drill runners, $2.25; diamond drill helpers, $1.80; crane men, $2.50; motormen, $2.25; machinists, $2.50; blacksmiths, $2.10; helpers, $1.65; carpenters, $2.25.

The Duluth, Mesabi & Northern Railroad has decided to build another ore dock at Duluth 1,200 feet long.

Pumps have been stopped at the Lake mine of the Cleveland-Cliffs Co., at Ishpeming, at its Salisbury mine, at the Lake Angeline and at the No. 7 mine of the Lake Superior Iron Co., and all these mines are now filling. Pumping is still continued at the Winthrop.

THE Calumet Furnace Co., of Chicago, held a meeting of its stockholders recently, and elected the following officers: President, William Barrett Ridgely; vice-president, C. F. Stuart; secretary and treasurer, C. H. Wilcox; directors, the above and Major Collins, of the Central Iron & Steel Co., Brazil, Ind., and Geo. M. Clarke, of Mitchell, Tranter & Co., Cincinnati, O. It is expected that the furnace will be ready to blow in shortly, and it will run a short time on foundry iron, probably turning on to Bessemer within a few weeks. It is understood that the company has made contracts for fuel and ore.

Shafting Manufacturers Get Together.

The manufacturers of cold rolled and cold drawn shafting have adopted a common classification and list of their product, which is to go into effect Sept. 1. Like the steel bar manufacturers who came together at Pittsburgh, on a new list of extras three months ago, the shafting men have had a diversity of base sizes, extras and discounts. There has been an utter lack of uniformity, and so tangled were the bids made by competing firms on shafting contracts, that the buyer had to go through a large computation, with each manufacturers' list before him, to find out which was lowest. There were a good many difficulties in the way of replacing these varying lists with a single one, but in the two months since the first meeting was held at Pittsburg, the manufacturers have been coming closer together, until at the August meeting held in Cleveland little time was required to adopt the new classification.

The advance in price is about $10 a ton. There is no forfeit or pooling of sales, merely an agreement to maintain discounts. How long it will continue will depend upon the conditions of business. For an ordinary demand, there is no excess capacity for the production of cold rolled and cold drawn shafting in the United States. The agreement does not include the numerous makers of turned shafting. The parties to it are Jones & Laughlins, Pittsburgh; Gautier department of the Cambria Iron Co., Johnstown, Pa.; Mahoning Valley Iron Co., Youngstown, O.; Akron Iron & Steel Co., Akron, O.; Fitzsimons & Co., Cleveland; Union Drawn Steel Co., Beaver Falls, Pa.; Compressed Steel Shafting Co., Boston, Mass.

Personal.

W. A. Kingsley, long connected with the sales department of the Union Iron & Steel Co., of Youngstown, O., goes to Pomeroy, O., as general manager of the company's plant there. J. A. Campbell, who has just resigned the Pomeroy position, goes to Youngstown to become general manager of the Mahoning Valley Iron Co.'s mills.

W. F. Deming, president of the Deming Co., Salem, O., recently started on a European trip.

H. M. Howe, Boston, G. C. Henning, New York, and W. W. MacKay, Glen's Falls, N. Y., are the American members of the International Conference on Testing Materials to be held at Zurich, Switzerland, Sept. 9, 10 and 11, to consider the adoption of standard methods of testing structural and other material. Among the reports to be presented are reviews of experiments on the behavior of cast iron at low temperatures, the phenomena of unreliability in ingot iron, methods of testing iron and steel, tests of corrosion of wire, compression tests of iron, etc.

J. G. Butler, of Warren, O. who died Aug. 21, aged 82 years, was connected in the '40's' with iron industries in Mercer county, Pa. He was the father of J. G. Butler, Jr., the well known iron manufacturer of the Mahoning Valley.

George W. Cook, formerly superintendent of the Rio Grande and Union Pacific railroads, has been made a sales agent for the Illinois Steel Co., with headquarters at Denver.

THE July issue of the *Street Railway Journal* contains a table giving interesting statistics of the street railroads of the United States. There are in the whole country 976 street railroads. The miles of track operated by electricity amount to 10,363; by horses, 1,914; by cable, 632; miscellaneous, 769; total track, 13,678. One mile of road with double track appears in these statistics as two miles. The total number of cars on these railroads is now 44,745.

THE Falcon Iron & Nail Co., Niles, O., has granted a 10 per cent advance to all employes whose wages are not governed by the Amalgamated scale.

PROPERTIES OF MALLEABLE CAST IRON.

In a previous issue of *The Iron Trade Review*, a synopsis was given of the excellent paper on "The Manufacture and Properties of Malleable Cast Iron," read by H. R. Stanford, before the recent Nantasket, (Mass.) meeting of the American Society of Civil Engineers. The inkling given in this abstract of the ground covered by the paper attracted no little attention from manufacturers of malleable iron, particularly in view of the scant literature on the subject—at least of any literature detailing the results of systematic and scientific study. While we have not space for the entire paper, we give liberal extracts below, together with the more important and interesting of Mr. Stanford's tables. An important part of the paper is the introductory portion in which the writer gives the results of experience with charcoal and coke irons, which ended in the substitution of the latter for the former:

Malleable cast iron is made principally from charcoal pig iron and a percentage of scrap or sprue sufficient to use the culled work, gates, runners and shrinkers that may result from the continued application of the process. After analyzing a number of kinds of pig iron, the author was led to believe that coke pig iron might just as well be used as charcoal pig, and developments have fully justified the assumption. The main difference between charcoal and coke pig iron is in the percentage of sulphur and in the cost; but if a good quality of coke is used, the sulphur is not high enough in the coke iron to affect its use. In table No. 1 are results of chemical analyses and of physical tests of bars made from the different pig irons, and upon those results the use of charcoal iron was discontinued when the iron in stock was used:

TABLE NO. 1 COMPARING PROPERTIES OF MALLEABLE CAST-IRON MADE FROM CHARCOAL PIG IRON AND FROM COKE PIG IRON.

FROM CHARCOAL PIG.					FROM COKE PIG.				
Heat number.	Number of bars averaged.	Maximum strength per square inch.	Per cent reduction.	Per cent elongation.	Heat number.	Number of bars averaged.	Maximum strength per square inch.	Per cent reduction.	Per cent elongation.
3....	3	46 500	4.5	3.2	153...	3	46 100	4.0	5.2
4....	2	42 300	4.1	2.8	166 A	3	51 000	4.2	6.8
7....	3	46 100	6.2	3.5	177...	4	49 100	8.1	9.2
9....	3	41 200	2.2	4.5	194...	2	48 800	3.7	4.0
10....	3	41 500	1.7	4.6	199...	1	45 800	4.1	5.0
13....	3	40 800	4.4	3.0	275...	3	43 100	2.1	5.0
14....	3	40 300	3.5	2.7	276...	4	41 100	2.8	5.1
15....	2	40 400	3.8	4.0	282...	4	49 500	5.4	4.3
16....	3	39 400	3.8	4.2	314...	3	42 000	3.7	5.5
17....	3	40 600	5.2	4.2	315...	4	43 500	3.6	6.4
18....	3	42 100	4.8	4.0	361...	3	56 100	2.6	5.7
22....	2	44 800	2.6	4.0	362...	3	52 000	6.6	8.0
110....	3	46 400	5.1	3.8	391...	3	45 100	5.5	5.2
113...	3	46 200	3.9	4.5	459...	3	44 200	2.1	4.2
117...	6	45 000	3.7	4.2	469...	3	51 600	7.7	7.0
Average.....		42 910	3.81	3.97	Average.....		47 930	4.41	5.81

Note.—Charcoal pig mixes averaged about 10 per cent coke pig iron. Coke pig mixes averaged about 10 per cent charcoal pig iron. Sulphur in first set of bars averages 0.042. Sulphur in second set of bars averages 0.063.

Sprue amounts to from 20% in heats for coupler or heavy work to 40 or 50% in light carriage work. An addition of 4% of heavy annealed scrap was introduced very successfully into all charges, and a large accumulation of the cheap and undesirable iron was disposed of. As much as 18% of annealed and broken couplers was tried experimentally in a charge for a coupler heat, and the resulting material was excellent, as far as quality was concerned, but the surfaces were not smooth and gave an impression of pock-marks. As annealed scrap can be secured at $4 a ton, and as a great many will take no exception to a rough-looking casting if of good quality, it seems as though there might be a use for the piles of broken couplers which a day's ride can hardly help revealing.

Furnaces and Fuel.

The furnaces used in melting malleable cast iron are cupolas and open-hearth furnaces. The open-hearth furnaces which the author has used are of two types, a straight forced draught furnace, using a good, hard, close, bituminous coal as a fuel, with an air pressure of four or five oz., and a Siemens-Martin furnace, using oil as the fuel. In the straight-draught furnace the fire was entirely drawn after the day's heats, and with no repairs could be used about three days. After three days the bottom needed a little fixing and the sides a little plaster, requiring an hour or two for the work. A renewal of some of the brick work was necessary about every six months. A charge of six tons would be ready to tap three and one-quarter hours from the time it was charged. The consumption of fuel depended on the number of tons a day melted, a certain amount of coal being necessary to heat the furnace for the first charge, whether nine or 20 tons were melted. If nine tons were melted, the coal consumed amounted to 0.6 lb. per pound of iron, and if 20 tons, to 0.45 per pound. The furnace loss was about 4% of the charge. Two men were needed to operate the furnace, the melter and the fireman; and four additional men were needed for about 15 minutes for charging each five-ton heat. The Siemens-Martin furnace, with oil as a fuel, was of the nature of an experiment. The furnace had a capacity of about eight tons, and was equipped with three oil burners at each end. As practically operated, that is, fired hard for 12 hours, the consumption of oil was 450 galls. in 24 hours. The checkers were used only for heating the air which was used in addition to the air used for atomizing the oil. Air was found far superior to steam as an atomizing agent, and was supplied by a compressor working under an accumulator pressure of about 60 lbs. At times there was considerable water in the air as delivered at the burners, and to convert that water into superheated steam, rather than to heat the atomizing air, the air blast was conducted through a hot coil just before reaching the furnace. Oil, even when burnt with an excess of air, seems to decarburize the charge very little, differing in this respect very materially from producer gas. The advantage of the oil furnace was in the saving of fuel cost (which saving is, of course, a function of location of plant), in having no ashes or refuse to deal with, and in having a furnace which could be used to suit the convenience of the molders without a corresponding fuel and attendance loss. The great disadvantage which might be overcome by additional experience was that the checkers became clogged too soon, and too much time was required for cooling down, cleaning and reheating. The labor to operate amounted to about 25% more than was required to operate the coal furnace. The furnace loss amounted to five per cent.

The manipulation of the charge in the oil furnace was practically the same as in the coal furnace, and the times for melting and heating were also nearly the same. About one hour and a half was required to melt completely six tons, the solid masses being shifted to hurry the melting. After the charge was melted, it was frequently rabbled, and the surface skimmed clean of all slag after the first good rabbling. Just before tapping, a second skimming was made. Two tests were made before tapping a charge; the first to see if the iron was "high enough," that is, to see if in the heaviest form into which it was to be poured the carbon would be practically all in the combined state. The determination for a charge for ordinary heavy castings was made by dipping out a little of the iron and pouring a bar about four inches long and one inch in diameter, and, after it had set, cooling it carefully in water. If cooled too rapidly, the shrinkage was such that nothing could be told by the fracture, but if properly handled, in four minutes from the time of dipping out the iron the bar could be cast, cooled and broken. If the iron was "high enough," the fracture would be entirely white, but if not, there would be little spots of graphite about the size of the head of a small pin, and more or less numerous, depending upon whether the iron needed much more or little more time in the furnace. The second test was for fluidity and was made entirely by eye, using blue spectacles for protection. If thin enough, the iron was a clear white; but if not, it had a kind of dark hue not easily described. If the charge was intended for car couplers or other very heavy work, the test bar would be larger, or about 1⅜ ins. in diameter. To secure thorough mixing in the furnace and to heat the hand ladles of the molders, the first ladle drawn by each molder was returned to the furnace through a side trough; but notwithstanding the precaution, the mixing was very imperfect, as may be judged by a reference to the first form in Table No. 2.

The cupola was used very advantageously in connection with the open-hearth furnace. It was used for the lightest patterns and for patterns where a uniformly superior metal was not of vital importance and for shapes in which a considerable shrinkage would not destroy all strength. The lightest

patterns were placed under the cupola because the fluidity of the cupola metal was greater than that of furnace metal, due to the higher percentage of carbon which resulted from the contact of the iron with the coke fuel. Ordinarily, if the charge is properly introduced, the quality of the product is very good, but at times the iron is not mixed in going down the cupola, and gray castings result. The high temperature of the iron and the excessive hardness which was necessary to avoid gray iron in the heavier shapes made the shrinkage of cupola iron destructive to some forms; as, for instance, a corner iron. In the cupola, a much larger percentage of sprue could be used than in the furnace, because of the recarburizing tendency of the fuel. A high percentage of carbon in the iron is necessary for fluidity and clean castings, and on the hearth the bath loses rather than gains carbon. Coke was used for fuel, and a small quantity of oyster shells or lime served to clean the iron and keep the cupola free from slag. About one-third of a pound of coke was used in melting one pound of iron.

For small work, hand ladles with a capacity of about 40 lbs. were used. Hard iron, if at the proper temperature for small work, scintillates brightly when tapped, differing from the more globular sputtering of gray iron.

Green sand, with a mixture of plumbago and cement for a facing, was used for molds. Most small shapes were cast several pieces on a gate, and the several pieces were so lightly attached to the runner that a slight blow was sufficient to detach them. Machines were advantageously used for making most molds.

After the Furnace Stage.

Depending upon the form of the castings, they were next either tumbled or pickled. If the tumblers were properly filled it was surprising to see the delicate shapes that stood the treatment without breaking. The pickle was a very dilute sulphuric acid, which was poured over the castings, and after being allowed to stand for a short time, was removed, together with the loosened sand, by a water bath. The hard castings were then inspected, and the good ones chipped of fins and gate connections.

After chipping and sorting, the iron was taken to the packing room where it was packed in pots for the annealing process. In order to avoid distortion or crooked work, and to get as much as possible in a pot, considerable care had to be exercised in the packing. Although the pots were jarred, and the packing consolidated as much as possible, there was always a further settling as the result of the heat in the annealing oven, and such a shape as a rim band for a buggy wheel, if placed with its axis hosizontal, would be flattened to an elliptical form; whereas if packed with its axis vertical, the band would settle with the packing and would not be distorted. Clean, heavy forge scales seem to make the best packing, everything considered.

According to all accounts of the manufacture of malleable cast iron which the author has been able to find, the packing must be an oxide of iron scale or some compound which, because of its chemical composition, with a certain degree of heat, can exercise a decarburizing influence upon the castings which it surrounds and so change the casting from a high carbon iron to a carbonless or wrought iron. The author's opinion is that the packing need not be necessarily a decarburizing agent, but that it should be of such a physical form that it will readily fill all small interstices between castings; that it should not fuse or slag under the temperature needed for annealing; that it should not adhere strongly to the castings or form into hard lumps increasing the cost of dumping and of tempering the packing, and that it should not be too expensive. The analyses and tests made by the author are evidence that good malleable cast iron is not a carbonless iron. An effort to anneal a brake shoe, so that the surface would be part hard and part soft, led to some specially prepared pots in which black oxide of manganese, clean river sand and sand mixed with a large proportion of ferro-cyanide of potassium, were used respectively. In every case the iron was as soft and malleable as it could possibly have been by any treatment. A sprinkling of powdered quicklime, after the packing has been tumbled and raked, and moistened a little with a solution of sal ammoniac, makes it less liable to pack hard in the burning, and renders the dumping of the pots much easier. Riddling out the small particles of dirt and scale does not benefit the packing.

In the experiments of the writer, a softer metal was obtained if the oven doors were allowed to remain closed for at least one day after the firing was stopped, and the scaling of the pots was much diminished. A day was sufficient to cool the pots with their contents to a black heat. Sometimes iron was packed in one large mass or bed, filling a part or the whole of the oven. The method effected a saving of pots, and cost no more in labor for packing, but was at a great disadvantage in time required to anneal the work thoroughly in labor, unpacking and in the percentage of distorted pieces. A grade of iron requiring five days to anneal if packed in pots would require seven days if packed in a bed.

Cost of Annealing.

A per pound estimate of the productive cost of annealing iron, based on an oven heated by two oil burners, and with a capacity of 30 pots, each loaded with 800 lbs. of iron, is as follows:

Labor packing pots	.0117 cent.
Labor loading oven	.0025 "
Fuel (including air for atomizing and attendance)	.0938 "
Labor unloading oven	.0025 "
Labor dumping pots and picking out the iron	.0104 "
Labor tempering and handling packing	.0083 "
Pots	.1000 "
Scale for packing	.0208 "
Total	.2500 "

TABLE No 2

SHOWING VARIATION IN CHEMICAL COMPOSITION AND PHYSICAL PROPERTIES OF IRON TAPPED FROM THE SAME HEAT BUT AT DIFFERENT TIMES.

Heat.	Unannealed or annealed.	C. C.	G. C.	Mn.	Si.	P.	S.	Maximum strength per square inch	Per cent reduction.	Per cent elongation	Hours annealed.	Remarks.
282	Sprue	2.98	0.18	0.21	0.88	0.152	0.091	40 200	3.8	4.0	108	Poured from first ladle drawn from heat.
	Annealed	0.38	2.41	0.21	0.80	0.136	0.091	39 800	.....	.....	"	
								39 400	3.4	4.0	"	
								38 700	4.8	4.5	"	
	Sprue	3.18	0.13	0.21	0.62	0.153	0.097	42 100	4.4	4.0	"	Poured from middle ladle drawn from heat.
	Annealed	0.08	2.17	0.22	0.64	0.151	0.096	42 700	2.9	5.0	"	
								42 100	3.1	4.0	"	
								42 400	2.2	3.5	"	
	Sprue	2.64	0.15	0.22	0.68	0.173	0.099	47 600	5.8	5.0	"	Poured from last ladle drawn from heat.
	Annealed	0.59	1.96	0.22	0.66	0.165	0.100	50 700	4.5	5.5	"	
								47 800	5.5	3.5	"	
								51 900	5.7	5.5	"	

NOTE.—Second specimen in table broke in shoulder.

CHEMICAL COMPOSITION OF SKIN AND OF INTERIOR OF AN ANNEALED SPECIMEN.

Heat No.	Sample taken from	C. C.	G. C.	Mn.	Si.	P.	S	Hours annealed.
361	Skin	0.61	0.73	0.15	0.65	0.154	0.116	120
	Interior	3.02	3.49	0.14	0.63	0.158	0.113	120

PHYSICAL PROPERTIES OF SPECIMENS FROM WHICH ALL THE SKIN HAS BEEN REMOVED

Heat No.	Days annealed.	Original diameter of test bar.	Reduced diameter of test bar.	Maximum strength per square inch.	Per cent reduction.	Per cent elongation.	REMARKS.
		Inches.	Inches.				
361	5	0.800	.648	44 200	.....	.....	Broke in shoulder.
361	9	0.800	.643	41 500	1.2	2.5	
362	5	0.800	.646	39 500	4.3	4.5	
362	7	0.800	.657	41 200	2.1	3.0	
362	9	0.800	.649	37 600	3.3	3.5	

NOTE.—The properties of undressed bars from the above heats may be found in Table No. 3.

After being annealed, the freshly dumped iron has a rich blue color which is probably given by a thin scale, and is entirely lost in the tumbling, which constitutes the last step in the process for making malleable cast iron. Upon the use which is to be made of the iron depends the details of the final process. For shapes where appearance is of little importance, a rough tumbling for a short time is sufficient. For pieces such as handles and buggy trimmings, which are placed in conspicuous positions and are sometimes tinned or nickel plated, a further treatment is necessary. After the rough tumbling follows a wet tumbling, in tumblers through which is running a current of water, which thoroughly cleanses the surfaces, and finally a dry polishing tumbling with pieces of leather.

Sections and Strength of Castings.

Next to iron, the most important element in malleable cast iron is carbon. A high percentage of carbon is necessary for fluidity; and fluidity is of prime importance, not only that the percentage of lost molds may be small, but that the iron may run clean and smooth, and the resulting work have a perfect surface. For strength and malleability the unannealed castings must have no graphitic carbon, but the total percentage must be in the combined state.

TABLE No. 3

SHOWING VARYING PHYSICAL PROPERTIES OF MALLEABLE CAST-IRON TEST BARS DEPENDING UPON TIME ANNEALED.

Heat number.	Maximum strength per square inch.	Per cent reduction.	Per cent elongation.	Hours annealed.
	42 000	4.1	6.0	79
	39 500	4.2	5.5	79
	37 200	3.9	5.0	79
	41 800	.....	8.0	79
	39 600	4.3	5.0	108
	40 800	2.4	5.0	108
	41 800	3.5	6.0	108
	42 100	1.0	4.5	108
276..	40 200	7.5	8.0	192
	42 800	8.2	8.0	192
	42 300	7.9	9.0	192
	43 800	10.7	8.5	192
	39 800	7.9	8.0	216
	40 500	4.7	6.5	216
	38 100	6.6	7.0	216
	39 800	2.9	6.5	216
	44 200	7.2	5.5	72
	43 200	5.1	5.0	72
	42 900	4.9	4.5	72
	50 400	3.0	5.5	120
	49 100	3.5	5.0	120
	50 600	4.8	4.5	120
	48 800	4.3	5.0	120
101..	46 900	4.6	6.0	192
	47 700	3.5	5.5	192
	46 000	6.1	4.5	192
	44 500	5.7	5.5	192
	47 400	8.6	7.0	216
	47 300	12.6	7.0	216
	47 300	5.3	6.5	216
	40 400	5.7	7.0	79
	42 300	5.9	7.5	79
	42 800	2.8	6.5	79
	44 300	2.4	5.5	108
	44 600	1.7	5.0	108
	43 500	2.2	4.5	108
275..	42 100	6.0	7.5	192
	40 000	9.0	6.5	192
	38 800	8.3	6.0	192
	42 100	4.6	7.5	192
	41 200	6.4	8.5	216
	40 600	7.3	6.5	216
	36 300	6.0	5.0	216
	42 200	8.4	8.5	216
	46 800	3.9	5.0	120
	43 100	4.0	5.0	120
	44 500	.....	.....	120
	45 300	5.2	5.0	168
67...	42 800	3.4	3.5	168
	44 300	4.3	4.5	168
	48 900	5.3	5.0	216
	47 200	7.0	5.5	216
	48 600	6.7	5.0	216
	18 600	0.0	0.0	79
	21 800	0.0	0.0	79
	11 500	0.0	0.0	79
	12 100	0.0	0.0	79
	18 000	0.0	0.0	108
278..	18 100	0.0	0.0	108
	26 300	0.0	0.0	108
	23 700	0.0	0.0	108
	11 400	.....	.....	192
	10 200	0.0	0.0	192
	6 300	0.0	0.0	216
	56 900	0.8	4.0	120
	55 400	4.2	5.0	120
	56 100	2.7	8.0	120
	59 600	5.3	4.0	168
361..	58 100	3.5	5.0	168
	52 100	1.6	2.0	168
	54 800	5.1	5.0	216
	52 800	4.1	3.5	216
	50 300	3.7	4.5	216
	50 700	5.9	8.0	120
	52 600	6.5	7.5	120
	52 700	7.3	8.5	120
	48 100	5.7	6.0	168
362..	58 000	4.7	4.0	168
	47 200	5.3	6.0	168
	46 700	5.1	5.0	216
	47 500	3.8	4.0	216
	51 100	3.6	5.0	216

NOTE.—Where the percentage of reduction or elongation is not given, the specimen broke in the shoulder.

Bars 278 were poured from a cupola heat charged for light work, and showed gray in fracture before annealing.

With a given molten-iron at a certain temperature if the iron be poured into a mold of a certain section the casting will contain all of the carbon in the combined state and the fracture of the annealed specimen will be of a uniform dark fibrous appearance.

If the mold be of a smaller section, the casting made from the same iron will show the total percentage of carbon as combined carbon, but there will be a surface chill, which in the annealed specimen will show as a white skin.

If the mold be of a greater section, then the rate of cooling of the iron will be so slow that a part of the carbon will have time to separate from the iron as graphitic carbon, and will show in the fractured unannealed casting as scattered spots of graphite about as large as the head of a small pin, the number of spots increasing with the section of the casting.

The above three castings, if annealed, will show the following physical properties: The first will have an ultimate strength of from 42,000 to 46,000 lbs., and will stretch and reduce about 6%, and may be considered a most desirable iron. The second will show in fracture a white crystalline skin, increasing in thickness as the section is lighter, with a black fibrous center; the ultimate strength will be about 52,000 lbs., and the stretch and elongation about 3 5% ; if the section is so light that the whole fracture is white, then the iron will be very malleable and tough. The third casting will be little better than gray iron, with a strength of from 25,000 to 35,000 lbs, depending upon the percentage of graphite in the unannealed iron, and with practically no stretch or elongation.

In Table No. 3, all specimens, with the exception of bars No. 278, are examples of iron included between the limits of the first and second cases cited above. Bars No. 278 were cast from a cupola melting iron for a very light class of work, and samples of the iron tapped at the time the bars were poured and which were cast in light forms were of exceptionally good quality; the test bars, however, were of too heavy a section for the charge, and before being annealed showed a uniformly gray fracture. It is noticeable that the period of anneal does not seem to affect the strength of bars No. 278, but that they break erratically, a behavior explained probably by the dogs in the grip of the machine not bearing fairly on the specimen as introduced and necessitating a distortion of the bar which was beyond the strength of gray iron. From the nature of the material the test bars could not with justice be dressed. In the second form of Table No. 2 are given analyses of the skin and of the interior of a test bar showing the difference to be one of carbon. In the third form in the same table are given the physical properties of the interior of test bars of two different heats, the samples from the same heats differing only in time annealed; tests of untooled bars corresponding with the above may be seen in Table No. 3. The thickness of the skin of the test bars averaged about 1-16-inch.

Effect of the Metalloids.

The chemical action in the furnace seems to be primarily the combining of the graphitic carbon of the charge with the iron, a combination made possible in the fused mass by the temperature; and secondarily a small burning out of carbon and slagging out of silicon and manganese. The secret of mixing is in using material containing combined and graphitic carbon in such proportions that at the temperature best adapted for pouring, the graphitic carbon shall all have combined with the iron. To assist in preventing chilling in the mold, a limited amount of silicon is desirable. A chill is objectionable because in one piece there will be two different kinds of iron which have different physical properties and which do not act the same in service. Either kind of iron by itself would be stronger than in combination with the other. Chemical action involves atoms; therefore if all carbon exists in the combined state in the annealed iron, it must be distributed through the mass in infinitesimally small particles, and when these particles are liberated from the iron in the subsequent process of annealing, they must each be enclosed in an iron cell. Hence the definition might be given for malleable cast iron that it is essentially a mixture of metallic iron and graphitic carbon, the carbon being in finely divided or atomic particles and the iron being the matrix for these particles. Gray iron differs from malleable cast iron in that the carbon, instead of being in atomic particles, is in crystals, and these crystals cut the iron structure and make it discontinuous. In malleable cast iron the continuous cellular iron structure is responsible for the strength of the product, and its malleability and ductility are limited by the non-deformable particles of graphite which occupy the cells. The process of making malleable cast iron is then first to make the hard brittle carbide of iron which is a stable compound at ordinary temperature. This step is possible because of the affinity of iron for carbon at high temperatures and the inability of the carbon to separate from the iron in the limited time required for the compound to cool in molds; and secondly, to change the carbon from the combined to the graphitic state by annealing. This step is possible because of the inability of the iron to hold carbon in combination if the compound is slowly cooled from a high to a low temperature.

Shrinkage is a function of casting temperature, and the nearer the iron is to the gray state and yet shows no graphite

in fracture, the less will be the shrinkage. The normal shrinkage of hard iron is very nearly ¼-in. to the foot, and there is an expansion of about ⅛-in. to the foot as the effect of the annealing process, so that the net shrinkage is about ⅛-in. to the foot, or about the same as for gray iron. Inasmuch as shrinkage depends upon the condition of the carbon, and the condition of the carbon depends upon the section of the molds, and because abnormal shrinkage is so undesirable, the necessity arises for different mixtures for different patterns. The shrinkage of cupola iron prohibits its use for a great many shapes, because of the imperfect mixing that necessarily characterizes cupola melting and because of the factor of safety required in the charge to be sure of avoiding gray iron in the castings.

After carbon, sulphur is the next important element in malleable cast iron. Sulphur tends to hold the carbon in combination with the iron and gives a stronger product because of the semi-steel which it produces. Sulphur is undesirable because of the hindrance it offers to annealing. The shapes ordinarily made by this process need not have great strength, but it is desirable that they be soft and capable of bending, and that the time of manufacture and cost be as low as possible. The effect of sulphur upon strength is well illustrated in Table No. 1. To show how sulphur affects the time necessary to anneal, couplers which analyzed about 0.040% in sulphur and in which were sections about 1½ ins. thick, were thoroughly annealed in 3½ days, while iron bands for buggy wheels, which were no more than 3-16 in. thick and analyzed about 0.150% in sulphur, were invariably hard if given less than five days. If sulphur is carried as high as 0.200%, enough carbon is retained in the combined state to give to fractures a uniform crystalline appearance, and the method is employed to make a so-called hard or special steel. This product in ordinary sections does not anneal in less than nine days. Special pains should be taken when buying coke for cupola melting to get a coke low in sulphur, as the iron coming in contact with the fuel picks up sulphur, and delay in the annealing process, with the accompanying wastes, is the result.

HINTS ON FOUNDRY CORE ROOMS.

BY HERBERT M. RAMP, SPRINGFIELD, MO.

Next to building the core room where it will not be crowded for room, the ovens are matters of the greatest importance. No foundry of any size or doing a variety of work can get along with less than two. One a large oven for all large cores, and the other a small one to dry small cores or to supply rushed or break down jobs, where the cores are dried in the day time. These small ovens can be built in a variety of ways, a few of which it may be profitable to mention. An ordinary cannon or caboose stove can be utilized for one of these at very small expense. Remove the stove top and cast a couple of plates 30 inches square, with a hole in one to suit the top of the stove, and one in the other the size of the stove pipe. Put a sheet iron wall between the two plates about 30 inches high, with a door in one side, use a number of rods or bolts across to serve as shelves, place on top the stove, connect the stove pipe, and the oven is complete. This oven will dry quite a number of cores in a day, and is easy to fire and cheap to handle. Another style of small oven is to build them of brick and use a cast iron plate to cover them. These are usually built about six feet square inside and seven feet high, with a small fire place in one corner. In the center put up a perpendicular shaft, fastened top and bottom, and at different heights of from 10 to 12 inches put on circular skeleton shelves about five feet in diameter, use set collars under these and fit them loose on the shaft so they can be revolved independently of each other. On one side put a row of doors the entire height of the oven, one for each shelf, so only a small opening will be made for the escape of heat when the oven is opened, as it often is when making small cores. The shelves can be filled or emptied by simply opening one door, or the shelf turned and cores placed farther from the fire if drying too fast or burning. This style is very handy and capable of drying quite large cores if necessary, besides an unlimited supply of little ones. It is also used in numberless places in the country, and nearly always gives perfect satisfaction.

There is also the little steam oven, used so often in shops where pipe fittings are made, that does excellent work. They are entirely devoid of any dirt or smoke, and require no attention to firing or burning of cores. Uniformity is easily attained in these, and those operating them can tell to the minute how long it takes to dry certain cores. It has always appeared to be one of the most admirable methods known to dry cores. A rather novel lit le oven came under my observation a short time ago. It was used in a brass foundry where numbers of small cores were used daily. It was built of brick, about six by eight feet square and six feet high, with shelves arranged all around the inside. For heating purposes a small stove stood in the center and connected to a flue with stove pipe. The heat from the stove dried the cores, and there was no more dirt than from a kitchen stove, and did very effective work.

The Millett Core Oven Co. also build small ovens that are not surpassed by anything in the market, and will meet the requirements of almost any shop for the purpose intended. The truth is there are numbers of good devices for such service, and we have only to investigate the subject a little to ascertain what they are. Large ovens require fully as much attention in construction as the small, and the variety is equally great.

Wood, coke, coal and steam are all used for heating purposes, and the locality determines largely the fuel used. Wood makes a very good fire, but is apt to be sudden and unreliable in its heat, gaining too much headway sometimes and burning the cores, and at others burning slow and leaving the cores green. Coal, if used in open ovens, is very dirty and contains so much gas it is almost impossible to gain access after the fire is lighted. But often when such fuel is used the ovens are built with a double floor, that is, the floor is covered with cast iron plates, with a space below, and so arranged as to cause the draft to circulate back and forth under the entire floor of the oven, finally passing out the stack. This system removes the objections of smoke, gas and dirt largely, and make a very good oven, but it is a question if the same amount of heat can be utilized from the same fuel as when the fire is direct. Coke makes the cleanest fire, as well as being the most uniform, and as a general rule the best results are obtained through its use.

Some care should be taken in the construction of a fire place for a large oven. Owing to the constant expansion and contraction, the wall in that vicinity is a hard thing to hold in shape. The wall for five or six feet above should be built of fire bricks and thoroughly secured. This can be done by building rails or cast-iron plates about a foot apart, or putting narrow cast-iron plates inside and out in that locality and bolting them together through the wall. Often it is advisable where a fire-box is used to make it of cast-iron plates about one and a half inches thick. They can be made in open sand at a trifling cost, and will last fully as long as an ordinary brick fire-box.

Where a large amount of oven room is desired, it is not economy to build very large ovens unless heated by steam. The better plan is to build more and to build them smaller. Six or eight feet wide and from 16 to 20 feet long is about the most economical size to build as regards heating, and the entire utility of all the room. When larger than this, it requires such a fierce fire in one end to heat the other that no cores can be placed near the fire for fear of burning, and if two fire places are used, it means additional expense in fuel, besides, when business is light the large oven must be fired just the same if only one-third full of cores.

In connection with large ovens a thermometer should always be used. They can be easily placed in position on the oven doors, and the watchman or man who fires the oven can learn to regulate his fire accordingly. From 250 to 280 degrees of heat give the best results. When much in excess of that temperature is used the cores are apt to burn. Not only do the cores come out in better shape and receive a more thorough and satisfactory drying, but the saving in fuel pays for the instrument in a very short time.

Every foundryman knows the trouble and anxiety it causes him when reaching the shop in the morning to find his cores burnt or green, and his work and business delayed and often seriously interfered with, while with the thermometer the

watchman or fireman can have no possible excuse for neglected duty.

It is also of great value in dry sand ovens, especially where the sand or mixture is of a nature that will easily burn. It was my misfortune to have two large dry sand molds burnt up in one month not long ago, and the loss in labor amounted to $40, enough to buy two thermometers.

Cars in core ovens are often a source of considerable trouble and annoyance. The heat affects the boxes and bearings and it becomes almost impossible to move them. Roller or ball bearings on either wheels or axles, with the rollers made a little loose to allow for expansion, make the best bearings for such cars, but there are a number of devices to effect the same end. One is to have a ratchet wheel fastened on one end of the axle, outside the wheels, to which is attached a lever with a catch. This gives a great leverage, and though rather slow enables one man to move a large load, and often answers very well.

It always pays to provide facilities for core makers to handle their heavy cores and plates, and that independently of the molding room. When the regular foundry cranes are used for such purpose, and the work has to be brought to them to be handled, it is a serious loss of time, besides often causing a great deal of delay, as both molders and core makers will be sure to want the crane at the same time. The best and most economical plan in the end is to erect a small crane in the core room for that purpose alone and provide it with the necessary fixtures for handling everything. Or, if compressed air is used in the plant, a trolley track and air hoist cannot be improved upon. But one fact is plain, it always pays for the money expended.

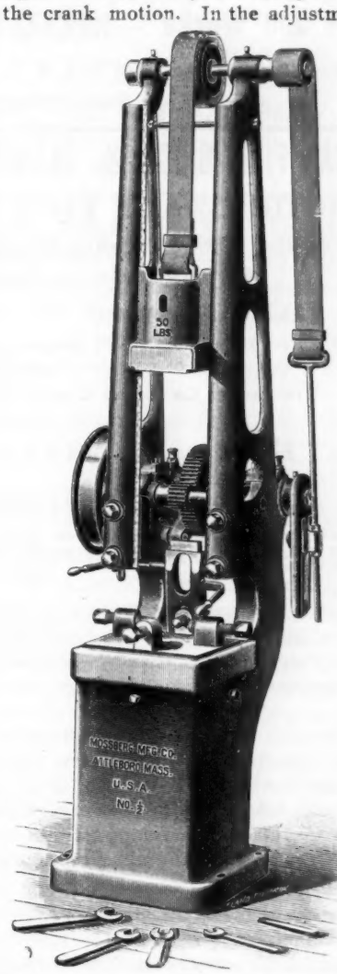
A core room should always be built large enough, have plenty of room to work in. A number of low benches are also very essential to set all the cores that are made in one day upon, until evening, when all the cores should be placed in the oven at once and the fire started. This is necessary where the fire is kept in the large ovens at night only, for allowing cores to stand in a warm oven all day dries the surface a little and from some cause renders them rotten and easily rubbed off. When the core room is large enough they can all be left outside until evening and then sprinkled with water, placed in the oven and the fire started.

Core plates occupy as important a part here as the level does to the carpenter, yet how often we see crooked, warped plates, and know it is expected good cores will be made on them. Some make their plate in open sand, or in the absence of the proper size, use bottom boards and express wonder the cores are not straight. It is just as sensible to expect a molder to make an open sand plate true with a crooked straight-edge and a defective level, as to expect a core maker to make straight cores on crooked plates, yet there are hundreds of them in use daily. It should always be our object to make all plates straight and true, little and big, and when they are large or long, plane them off or face them on the boring mill. In this way true, straight cores can be obtained.

Long plates are especially hard to keep straight, even when planed if cast with deep ribs on one side, the heat, coming up under the plates, expands the ribs underneath first, causing the center to bow down, while the core on top plate being in a green state resists the action of the heat and settles down in the curve formed by the un-uniform expansions. After some time when the core becomes partly dried and hot the plate straightens to its normal condition and the core is left resting on the center with both ends off the plate. Such was my experience in making some large square cores ten feet long. In the morning I would notice the ends of the cores had apparently raised off the plates an eighth of an inch. The plates showed perfectly true, and the problem was puzzling until its repetiton showed where the trouble lay. As before stated, when the plate first bent, the core was green and settled with it, but by the time the entire plate reached a uniform heat the core was so rigid the heavy rods used in it held it off the plates, when it straightened out. Ribs should be avoided as much as possible in such plates. Make them heavier, and if a rib is necessary make it broad and flat. —[Machinery Molders' Journal.

AUTOMATIC DROP PRESS.

The machine illustrated is especially adapted to the manufacture of sheet metal work, hardware novelties and all classes of swaging and flattening. It is built in six sizes, with hammers varying from 50 to 500 pounds. The mechanism is simple and durable. On the shaft with the driving pulley is fastened a pinion which drives a crank shaft gear. This gear is connected to its shaft by a roller friction clutch, which responds instantly the small handle is raised; otherwise the driving pulley revolves freely on its shaft. The construction of the cheeks for the crank shaft affords ample working space for the operator; the guides for the hammer are substantially fastened and cannot be thrown out of line by strain or vibration. The left guide is adjustable, so that wear and lost motion can be taken up. All the bearings are fitted with bronze bushings, and the length of stroke may be changed by varying the length of the crank motion. In the adjustment of the dies



the flange pulley is turned by hand to raise and lower the hammer during the setting.

When power is applied the hammer is raised to its gauged height. The clutch is then automatically thrown out, leaving the hammer suspended. It is securely locked in that position until released by the tripping lever when moved by the operator. The clutch mechanism plays an important part in the action of this press. It acts immediately as the hammer rebounds from the die.

The smaller sizes of these machines are provided with a safety stop to prevent the accidental dropping of the hammer on the operator's hands. The die holder or ordinary poppets may be used. The manufacturers are the Mossberg Mfg. Co., Attleboro, Mass.

THE big steel girder, 123 feet long, 9 feet 10 inches high and 22 inches wide, recently built by the Shiffler Bridge Co., of Pittsburgh, for the Philadelphia bridge over the Reading tracks, weighed about 50 tons. It was carried on two iron cars, with a car in the middle and one at each end as idlers. The two iron cars were capable of carrying 100,000 lbs. each. The girder fell off in going round a curve, en route, but was not damaged, falling clear of the train.

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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

W. H. Henderson, Johnson City, Tenn., will buy belting, shafting, hangers, pulleys, etc.

The Cortland Forging Co., Cortland, N. Y., has been incorporated to manufacture carriage forgings and hardware. Capital $100,000.

The Illinois Central's new car shops at Burnside, Chicago, will have three buildings 160x360 ft. each. They will be equipped with new machinery.

The Indian Orchard Screw Co. has been organized at Springfield, Mass., to manufacture machine screws and bicycle fittings. G. O. Gridley, of Springfield, Vt., is manager of the concern.

The Quast Gas Engine Co., Strasberg, Ill., has been incorporated with a capital stock of $50,000, to operate a general foundry business. Incorporators are G. W. Gwin, J. N. Storm, J. F. Ulmer, M. Hamm and Charles Quast.

The Stanley Cycle Mfg. Co. has been incorporated in New York with a capital of $100,000 to manufacture high grade bicycles. The company expects to turn out between 10,000 and 15,000 wheels per annum. Leo Schlesinger is president, L. Stern, secretary and treasurer. Offices are 129 and 131 Crosby street, New York.

The Northern Electrical Mfg. Co. has been organized recently at Madison, Wis., for the manufacture of dynamos, motors and other electrical machinery. The company is at present putting up a plant. The officers are Wm. F. Vilas, president; C. M. Conradson, vice-president and mechanical engineer; D. C. Jackson, electrical engineer; A. O. Fox, secretary and treasurer, and E. G. Richards, superintendent.

Additions, Enlargements, Removals, Etc.:—

The Washburn & Moen Mfg. Co. is to add a large building to its Quinsigamond plant at Worcester, Mass. The building is to be used for steel melting and will be 100x60 feet.

The Coe Brass Mfg. Co., of Ansonia, Conn., is to build an extensive addition.

The Eagle Iron Works, of Geo. B. Sennett, Meadville, Pa., are to be removed to New Castle, Pa., it is reported. A 10-acre site has been purchased.

New Construction:—

The Cooper Mester Metal Wheel Co. has taken out a permit for the erection of a manufacturing plant at Toledo, O.

The West Virginia Central & Pittsburg Railroad will erect a foundry for manufacturing car wheels, brake shoes, etc., at Elkins, W. Va.

The Dickson Car Wheel Co., Houston, Tex., proposes to erect a foundry for the manufacture of architectural work, machinery, etc.; it will also build a new machine shop.

The Minneapolis Rolling Mill Co. has resumed work on its buildings at Columbia Heights, a suburb of the city. Part of the buildings were erected in 1892-93, but the business depression stopped work. Operations in the mill will begin as soon as they can be put in readiness. The product will be bar iron, nuts and bolts and general forgings.

Fires and Accidents:—

The Mud River Mfg. Co.'s engine house at Mud River, Ky., burned with $6,000 loss.

Considerable damage was done by Saturday's storm to the stacks at Carrie furnaces, Rankin, Pa.

A 12-ton fly wheel burst at the Oliver Iron & Steel Co.'s South Tenth street mill, Pittsburg, Aug. 22. Several thousand dollars damage was done, but no one was injured.

General Industrial Notes:—

Furnace No. 2, at Shelby, Ala., will be ready to blow in about September 1.

It is stated that the North Cornwall furnace, at North Cornwall, Pa., will go into blast in September.

The Dover Rolling Mills, of Flemington, N. J., have resumed after a shut down of two months.

At the locomotive works of H. K. Porter & Co., Pittsburg, a 10 per cent advance in wages has been made.

The Burgess Steel & Iron Works, of Portsmouth, O., has advanced the wages of 150 employees 5 per cent.

The furnace at Buena Vista, Va., which was recently leased by the Rich Patch Iron Co., has been put in blast.

At Milwaukee, Judge Austin issued an order on President J. E. Griffin and Secretary L. D. Rosenheimer, of the Milwaukee Malleable Iron Co., to show cause why a receiver should

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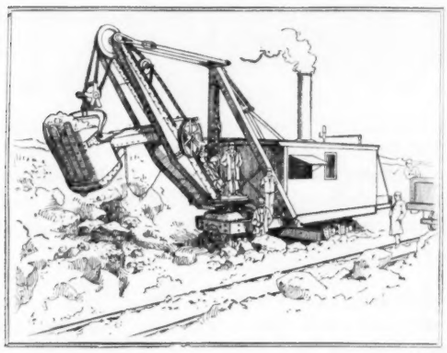

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CENTRIFUGAL DREDGING PUMPS	6-inch to 36-inch. With either simple, compound or triple engines.

SOUTH MILWAUKEE, WIS.

not be appointed. J. P. Hummel, a stockholder, started the proceeding. The company has $100,000 capital, and its large plant is located at Waukesha.

The Robinson Iron Co., of Plymouth, Mass., is preparing to resume work again. The plant shut down some years ago.

The No. 1 furnace of the Cambria Iron Co., Johnstown, Pa., out of blast for some time, has been relined and is in shape to resume.

The furnace of the Embreeville Iron Co., of Embreeville, Tenn., will go into blast Sept. 15. It has a capacity of 200 tons of iron per day.

The South Boston Iron Works, at Middlesborough, Ky., are to be sold on Sept. 9 to satisfy a judgment of $154,000 in favor of the Atlantic Trust Co.

Checks, amounting to $115,000, have been sent by the receiver of the Lorain (O.) Mfg. Co. to the creditors. This cancels about 90 per cent of the amount due them.

The Buena Vista Iron Co., Buena Vista, Va., is preparing to put in an 800 h. p. engine and a battery of boilers. About 300 hands are now working at the mines and furnace.

The expectation is that the Consolidated Wire & Steel Co.'s Cleveland plant, formerly the Baackes works, will start in full by Sept. 15. Some changes and additions are under way.

At Middlesborough, Ky., the Watts Syndicate's No. 1 furnace will soon go into blast with capacity increased from 150 to 200 tons daily. No. 2 furnace will be improved to the same extent.

Robert Ewing, of Nashville, representing the bondholders, has purchased the Central Iron Co.'s four furnaces at Centerville, Ala., and will probably put them in blast in the near future.

A Steubenville, O., dispatch says that capital from New York and Pittsburg is negotiating for the purchase of the Brilliant Steel & Iron Co.'s Works, with a view to converting them into a mill for the manufacture of pipe and tube iron.

A mortgage for $7,000,000 has been given by the Maryland Steel Co. to the Girard Life Insurance, Annuity & Trust Co., of Philadelphia, as arranged for with the creditors when the receivership ended The Maryland and Pennsylvania Steel companies will issue jointly $4,000,000 bonds, secured by the mortgage and $3,000,000 additional will be issued later at the maturity of bonds to that amount now outstanding.

New car and locomotive building: Illinois Central has issued specifications for 50 locomotives. Brooks Locomotive works are building 10 engines for the Burlington, Cedar Rapids & Northern. The Baldwin Locomotive is building several engines for South America, besides scattering home orders. The Canadian Pacific will buy cars largely, for the grain movement. United States Car Co. has the order of the Calumet & Blue Island for 200 cars.

Work on the Cleveland-Cliffs Iron Co.'s charcoal furnace at Gladstone, Mich., is going on rapidly. The foundations for the stack, oven and casting house have been completed and a battery of 40 kilns is under way. The chemical plant for the manufacture of wood alcohol is going up rapidly. The machine shop is finished and most of its equipment is in place. The furnace dock has an area of 90,000 square feet and a storage capacity of 1,800,000 tons.

The Link Belt Machinery Co., of Chicago, has more contracts on hand now than at any time in the past five years. Recent orders for the Standard water tube safety boilers have been received from the following: Western Electric Co., Chicago, 600 h. p.; Globe Soap Co., Cincinnati, 250 h. p.; Mabley & Co., Bld., Detroit, 700 h. p.; Jobbins & Van Ruymbecke, Aurora, 150 h. p.; Keystone Woven Wire Fence Co., Peoria, Ill., 75 h. p., and Cincinnati Edison Co., Cincinnati, 500 h. p.

The universal Telephone Co., of Indianapolis, Ind., reports a large demand for its telephones which are especially designed for factory uses. Among recent orders for factory equipments are named the Nordyke & Marmon Co., of Indianapolis, Norton Emery Wheel Co., American Well Works, Peerless Mfg. Co., Superior Drill Co. There is an increasing demand for the instruments of this company to facilitate the business of large concerns and the orders recently received indicate increased business in all industrial lines.

The plant of the Troy Steel & Iron Co., Troy, N. Y., was sold at auction Aug. 22, Frank S. Witherbee bidding $400,000

for it on behalf of the reorganization committee. It is the intention of the committee to sell the real estate in Troy and erect mills, to cost $600,000, for the manufacture of steel billets, close to the company's blast furnaces on Breaker Island, opposite Troy. The committee on reorganization consists of H. H. Rogers, representing the Standard Oil Co., J. S. Morgan and Smith M. Weed, representing the Hudson River Ore & Iron Co., F. S. Witherbee, the Port Henry Iron Co., and Horace G. Young, the Delaware & Hudson Canal Co. This committee has recommended a plan for continuing operations and liquidating the $1,400,000 liabilities.

The Westinghouse Machine Co., Pittsburg, reports business active and the outlook very flattering. Orders for compound engines the past month include one 250 h. p. to Whittenton Mfg. Co., Taunton, Mass.; one 100 h. p. and one 125 h. p. to American Hydraulic Dredging Co., East Douglas, Mass.; one 80 h. p. and one 100 h. p. to Sioux Consolidated Mining Co., Mammoth, Utah; one 200 h. p. to Wendell & Smith, Overbrook, Pa.; two 80 h. p. to Upper Peninsula Hospital for the Insane, Newberry, Mich.; four 250 h. p. to United States Capitol Building, Washington, D. C.; one 250 h. p. to Connellsville Electric Light Co., Connellsville, Pa.; one 250 h. p. to Belvidere (Ill.) Electric Co.; three 160 h. p. to Carnegie Library Building, Pittsburg, Pa.; one 125 h. p. to Hackensack (N. J.) Gas & Electric Co.; one 300 h. p. to Wilkinsburg (Pa.) Electric Co.; one 250 h. p. to Sing Sing (N. Y.) Electric Co.; one 200 h. p. to Gloversville (N. Y.) Electric Co. In addition to the above, the increased number of orders for Standard and Junior automatic engines, would indicate a general revival in all branches of manufacturing.

G. A. R. AT LOUISVILLE.

One Cent Per Mile Over Pennsylvania Lines for National Encampment.

The rate to Louisville, Ky., for the Twenty-ninth National Encampment of the Grand Army of the Republic will be based upon One Cent per Mile from Ticket Stations on the Pennsylvania Lines. Excursion Tickets will be sold at that rate September 8th, 9th, 10th and 11th, 1895. The Return Limit will cover sufficient time for an extended sojourn, and will be ample for side trips. Southern Railways are expected to make special rates to historic places, and to commercial and industrial centers, enabling visitors to see the South at slight expense. Low rates have already been arranged for the Chickamauga National Military Park dedication, which takes place shortly after the Encampment at Louisville closes. Excursion tickets to Chattanooga for the dedication will be sold over Pennsylvania Lines Sept. 16th to 19th, inclusive.

Special arrangements may be made by Posts desiring to go in a body, or parties of friends wishing to travel together can be satisfactorily accommodated if they will kindly make their wants known to the undersigned. Valuable information will be cheerfully furnished all applicants, and any required aid in shaping details will be promptly extended. It will pay to investigate. C. L. Kimball, Ass't Gen'l Passenger Agent, Cleveland, O.

The Century will begin in November the publication, as a serial, of Mrs. Humphry Ward's new novel, upon which she has been at work for the past two years. It will be called "Sir George Tressady."

Excursion to Mackinac via Valley Railway.

On Tuesday, Sept. 3, the Valley Railway will run an excursion to Mackinac, via Cleveland and D. & C. Palace Steamers, at rate of $5.00 for the round trip from any station between Valley Junction and South Park inclusive, thus giving its patrons an excellent opportunity for sport and sightseeing.

WORK will be commenced in ten days on the 300 coke ovens which will be the beginning of the proposed steel plant at Bessemer, Ala. It is also stated that Henry F. De Bardeleben, of Birmingham, has purchased the two idle furnaces at Fort Payne, and will remove them to Bessemer so as to form part of the steel plant.

THE Union Rolling Mill Co., Cleveland, is putting in a new engine, a squeezer, and a new three high train at its puddle mill in Newburg. A waste heat boiler also is being placed over a heating furnace. It is the expectation to have the plant in full operation Sept. 20.

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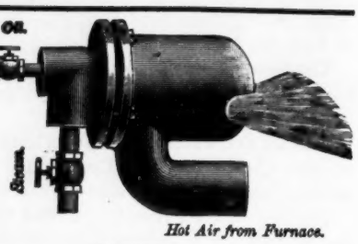

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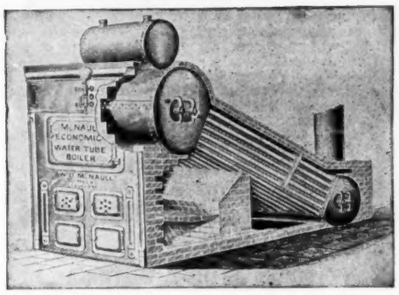

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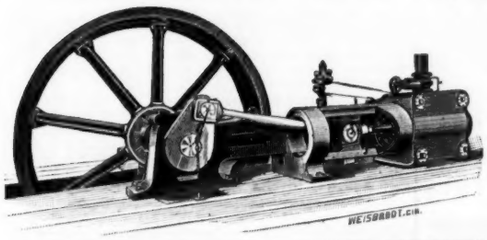

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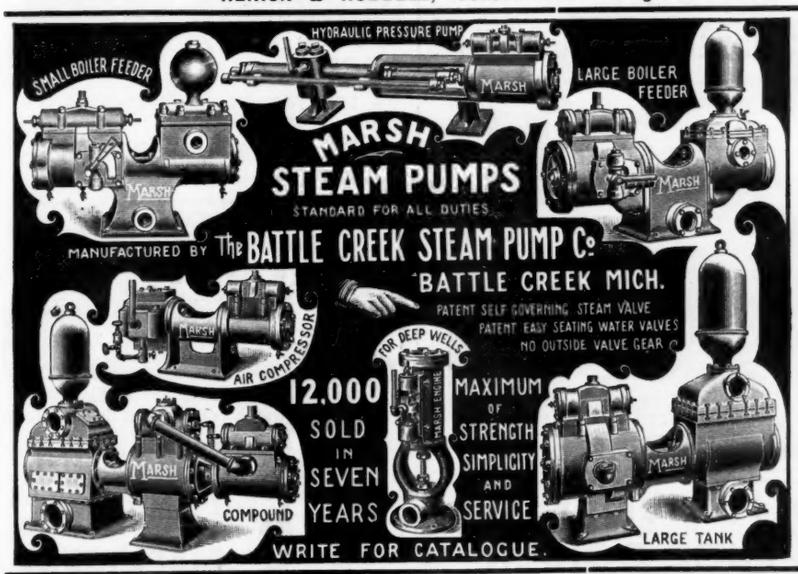

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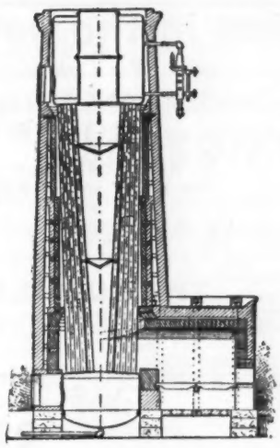

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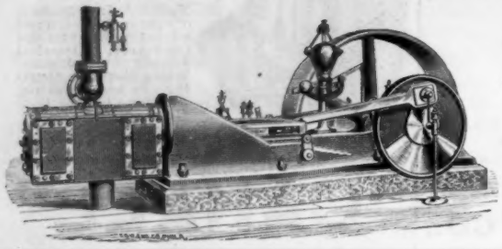

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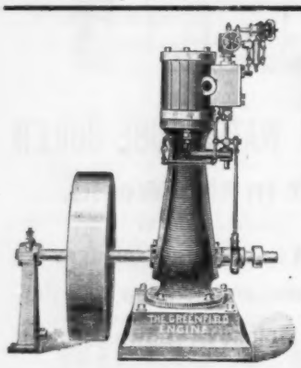

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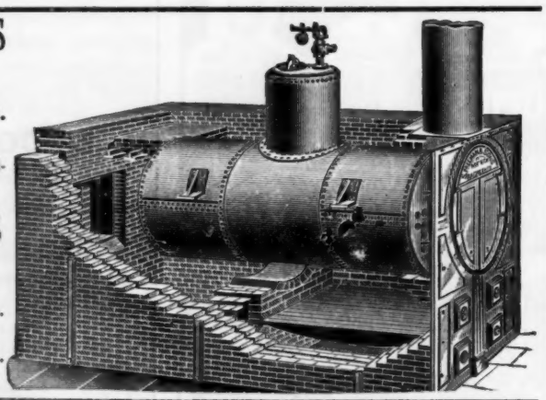

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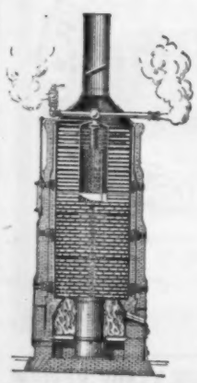

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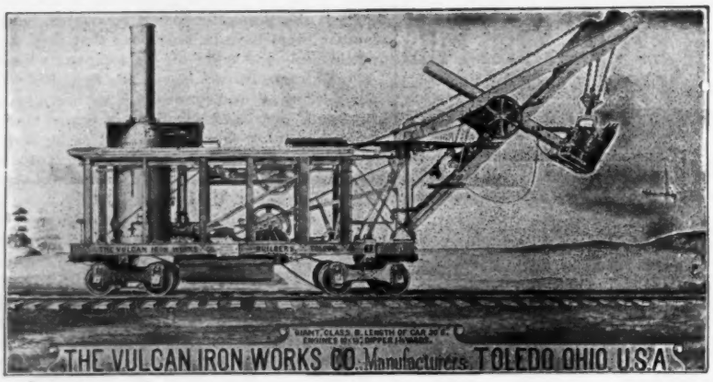

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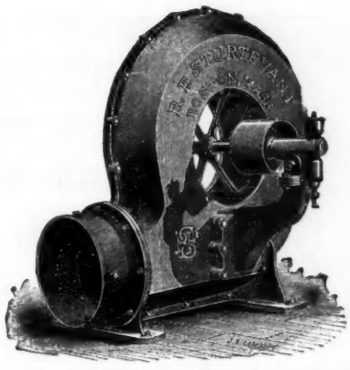

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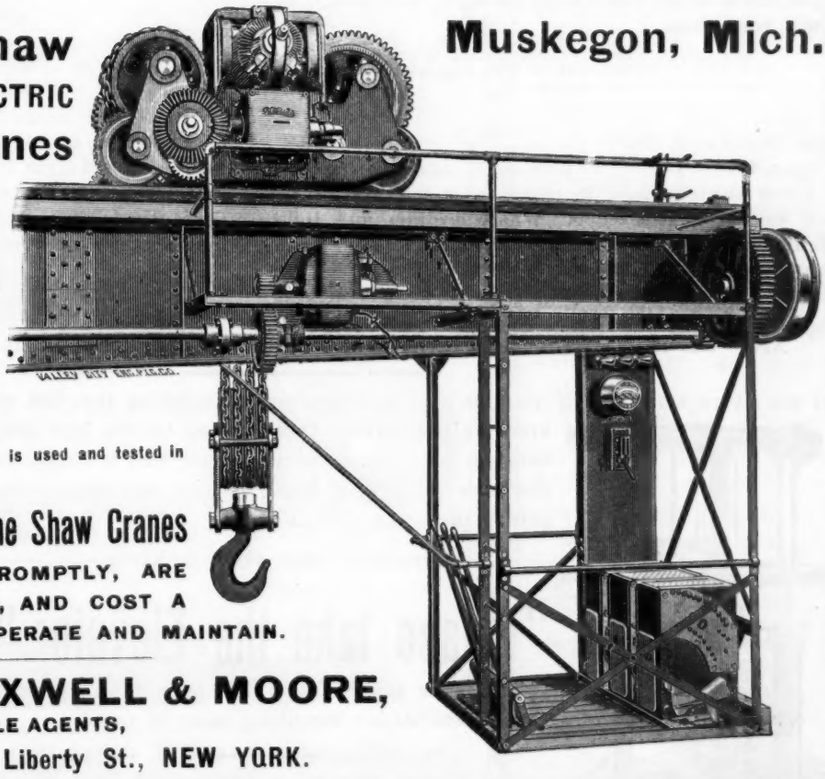

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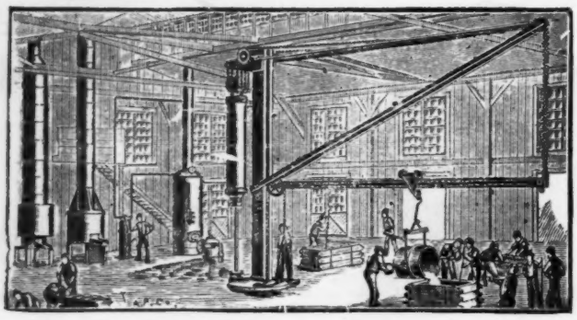
If you do not get a good deal more money for your goods than you have been getting. Your competitor has a big stock of raw material bought before the rise, has he, and if you advance your prices like you ought he will rush in, undersell you and take your trade, eh?

"BETWEEN THE DEVIL AND THE DEEP SEA?"

Bad place to be, sure, but let us tell you a thing or two. Do you know that if you adopt the wonderful

Ridgway Balanced Steam-Hydraulic Crane



5-ton Steam-Hydraulic Crane in a Foundry.

You can make such marked savings in the cost of making your goods that you would be simply amazed. If you will enter into correspondence with us we think we will soon satisfy you. Just as a little indication, glance over these four short letters:

We suppress names because we are afraid these people would not like their names used in public testimonials. If you ask we will tell you who they are.

CRAIG RIDGWAY & SON:

DEAR SIRS:—We have your favor asking if we had any objection to your using the letter you have from us praising your Crane in your newspaper ads. I sent your letter into our President, Mr. ——, and he wrote across it: **"We cannot indorse the Ridgway Crane too highly. We will take out all our other Cranes and put in the Ridgway."** I merely tell you this to let you know how thoroughly well pleased we are with your cranes.

Signed by one of the largest and best equipped foundries in the West, employing over 1,000 men.

CRAIG RIDGWAY & SON:

DEAR SIRS:—It gives me pleasure to state that the Ridgway cranes which we have in operation at our works have given us entire satisfaction. **Where medium and light weights** (under 25 tons) **have to be handled I do not know of any type of Crane that equals them.**

Signed by one of the largest Steel Works in this country, employing about 4,500 men.

CRAIG RIDGWAY & SON:

DEAR SIRS:—Answering yours in regard to cranes purchased from you will say, **I fully agree with you in saying they are the Best Foundry Cranes on Farth to-day. There is not one objectionable feature in them.** We have them in constant use. Our molders' helpers operate them with perfect satisfaction.

Signed by the largest concern in the Northwest, employing 2,000 men.

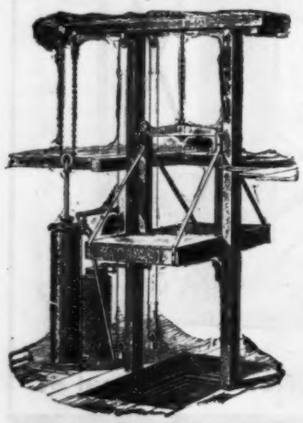
CRAIG RIDGWAY & SON:

DEAR SIRS:—I would say we are well pleased with the service of your Steam-Hydraulic Crane. As you know, we have 8 of them in our works, four of which are in hourly service day and night handling plate iron, and operated by unskilled labor. The service is constant and severe and yet the repairs to your cranes during the three or four years we have had them has been very little.

Signed by the largest manufacturing concern in this line in the world, employing 4,000 men. They have, since writing this, put in more of them.

AND WE HAVE JUST DOZENS OF SUCH LETTERS. IF YOU'LL WRITE US YOU'LL SEE.

You are a very slow man if you don't at least investigate a machine that has endorsements like this. Don't you know we are making these cranes for the best concerns all over the country because they are such remarkable Money Makers? Your competitors are getting them and so must you.



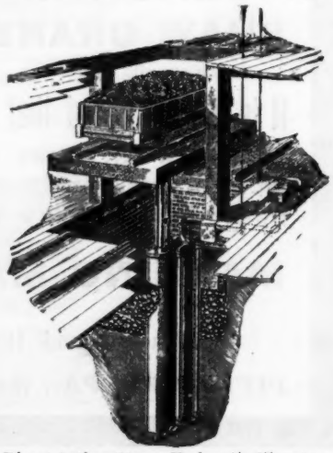
Steam Hydraulic Elevator, also made direct acting with cylinder under platform.

Circular for the Asking.

"Please take the Elevator."

This is the best machine for the purpose ever designed, and we are furnishing many of them.

CRAIG RIDGWAY & SON
COATESVILLE, PA.



Direct Acting Steam Hydraulic Elevator.

MACHINE TOOLS

IN FIRST-CLASS CONDITION.

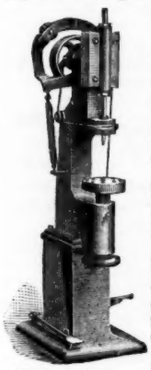
37 in. Niles Tool Works Vertical Boring and Turning Machine, 2 Heads.
72 in. Niles Tool Works Vertical Boring and Turning Machine, 2 Heads.
16 in. F. B. Miles Slotting Machine.
2,400 lb. Miles Steam Hammer, Single Standard.
30 in. by 27 ft. Pratt & Whitney Engine Lathe.
Horziontal or Floor Boring Machine, Pratt & Whitney.
Two (2) 5 ft. Universal Radial Drills.
22 in. x 8 ft Ames Mfg. Co. Lathe, with Turret Head, Hollow Spindle.
21 in. x 11 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
19 in. x 8 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
26 in. x 8 ft. Pond Machine Tool Co. Engine Lathe.
19 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
22 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
21 in. x 11 ft. Lodge & Davis Engine Lathe, Hollow Spindle and Taper Attachment.
40 in. Bement Vertical Drilling Machine,
24 in. Pratt & Whitney Vertical Drilling Machine.

GEORGE PLACE MACHINE CO

145 Broadway & 86 Liberty St., New York.

NOTE THESE FACTS.

By the use of John Adt's Aut. Wire Straightening and Cutting Machines, Elastic Rotary Blow Riveting Machines and Tools, we have raised the standard of our work and increased our sales, for by their modern construction and time saving devices, the great production and good quality of work has enabled us to quote prices by which our customers would buy in large quantities.



Riveting Machine.

Others say they would have none other than John Adt's Machines and Tools. (This is the good news we are continually receiving.)

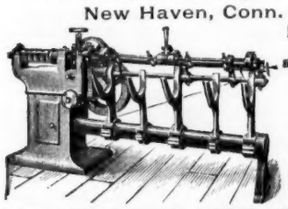
We also manufacture special Aut. Forming, Butt Mill, Drilling Machinery, Dies, Tools, etc., for the manufacture of Hardware, Bicycles, Saddlery and Sheet Metal Goods.

Estimates and advice as to manufacture of any articles furnished. Correspondence solicited. Give us a trial and be convinced.

JOHN ADT & SON,

F. B. SHUSTER, Prop.

New Haven, Conn.



Automatic Wire Straightening and Cutting Machine.

N. B. In addressing be sure and mention Dept. C.

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is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

Special Inducement to Hardware Dealers.

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Used and endorsed by many of the largest manufacturers of castings and metal work in all branches.

Write for descriptive circular.

ChicagoChemical Solution Mfg. Co.

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SECOND-HAND MACHINERY!

16"x16"x3' New Haven Planer. 24"x24"x6' Pease Planer. 30"x30"x8' Pease Planer. 32"x32"x8' Pond Planer, good as new. 32"x32"x10' D. W. Pond Planer, two heads, in fine order. 32"x32"x12' L. W. Pond Planer. 12"x5' Barnes Lathe with Chuck. 13"x6' Pratt & Whitney Engine Lathe. 13" x6' Pratt & Whitney Engine Lathe, taper attachment, good order. 16"x6' Flather Engine Lathe, with Turret on Shears, good order. 16'x6' Prentiss Engine Lathe, as good as new. 23"x10' Fitchburg Engine Lathe. 27"x14' New Haven Lathe and Chuck. 60" Triple Geared Engine Lathe, used but three months, a modern tool. No. 2 Prentiss Screw Machine. No. 3 Pratt & Whitney Screw Machine for bicycle work. 26" Pratt & Whitney Chucking Lathe, fine order. 5 ft. Niles Horizontal Cylinder Boring Machine, with facing attachment, good as new. Betts' Horizontal Boring Machine, complete with all attachments, good as new. No. 5 Heavy Garvin Plain Miller, with vise, index centers, 47" table, in fine order. Heavy Slab Milling Machine, cheap. Garvin Cutter & Reamer Grinder, with vise and centers, A1. Gould & Eberhardt Gear Cutter. 3 Small Punching Presses. Heavy Ferracute Press. 14" Plain Fox Lathe with Slide Rest. 16" Fox Monitor, shop worn. 24" Crank Shaper, shop worn. 2 Small Sensitive Drills, with chucks. 1½" Lodge & Davis Bolt Cutter, fine order. 4-Spindle Gang Drill, power feed, shop worn.

Send for photographs and descriptions of the above tools. Our catalogue of bicycle tools now ready. Sent upon application.

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62 and 64 South Canal St., CHICAGO, ILL.

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ELECTROTYPING & ENGRAVING

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We don't Make, We Sell Machinery.

We use our judgment and experience of 30 years in buying the best machinery made for its purpose.

We control the entire output of some shops. They make. We sell. We are both specialists.

You get the advantage of this special judgment and experience *free*, in buying from us.

In stock, ready to ship, in Boston and Chicago, standard sizes of the standard makes of Lathes, Planers, Upright Drills, Milling Machines, etc., *at manufacturers' lowest prices.*

HILL, CLARKE & CO.,

Machinery Merchants,

156 Oliver St. BOSTON. 12-14 N. Canal St. CHICAGO.

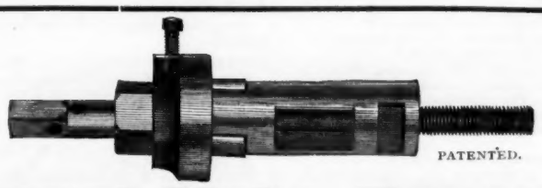
A small investment will carry an assortment of our

"SPLIT COLLARS,"

sizes to correspond with the shafting you use. They can be put on without disturbing pulleys or boxes. Write for circular.

THE GOUVERNEUR MACHINE CO.,

COUVERNEUR, N. Y.



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National Tube Expander.

WITH CUTTER ATTACHMENT.

The best, cheapest, and only tool with flue cutter on the market.

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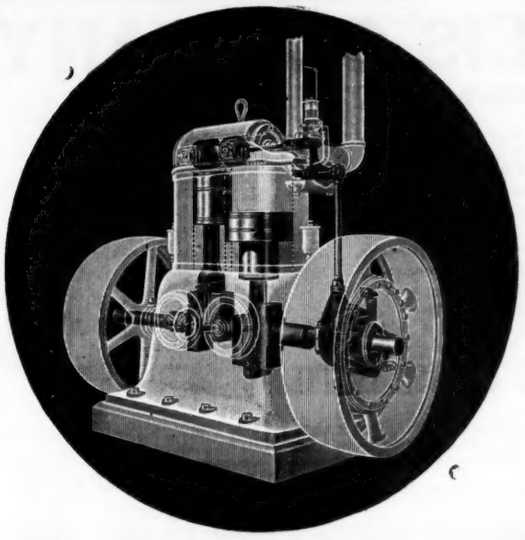

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COMPOUND, 5 to 1,000 h. p. Unequaled simplicity, high efficiency and moderate cost.

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Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Hamilton Fdy. & Machine Co., Hamilton, O.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Mechanical Engineers—
John Fraser, Chicago, Ill.

Metal Saws—
Q. & C. Co., Chicago, Ill.

Milling Machines—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Lodge & Shipley Machine Tool Co., Cincinnati.
George Place Machine Co., New York City.

Mining Machinery—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.
C. H. Besly & Co., Chicago, Ill.
W. A. Crook & Bro's Co., Newark, N. J.
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

Moulding Sand—
Ohio Sand Co., Conneaut, O.
Milwaukee Fdy. Supply Co., Milwaukee, Wis.

Nickel—
Canadian Copper Co., Cleveland, O.

Oil Cups—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Oil Pumps—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Ore Crushers—
The Edward P. Allis Co , Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.

Packing—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City, N. J.
Empire Paint & Roofing Co , Philadelphia, Pa.

Pattern Letters—
H. W. Knight & Son, Seneca Falls, N. Y.
Milwaukee Foundry & Supply Co., Milwaukee, Wis.

Pattern Makers—
Milwaukee Fdy. Supply Co., Milwaukee, Wis.

Pattern Works—
Gobeille Pattern Co., Cleveland, O.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.

Pipe Covering—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Planers—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Lodge & Shipley Machine Tool Co., Cincinnati.
George Place Machine Co., New York City.

Plumbers' and Gas Fitters' Supplies—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Portable Core Ovens—
Millett Core Oven Co., Brightwood, Mass.

Portable Forges—
Buffalo Forge Co., Buffalo, N. Y.
Cady Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.

Presses—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
C. H. Besly & Co., Chicago, Ill.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.

Pulley Blocks—
Moore Mfg. & Foundry Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

Pumps (Steam)—
Ed. Wertheim, Chicago.
W. G. & G. Greenfield, East Newark, N. J.
Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

Pyrometers—
Edward Brown, Philadelphia, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.
Ed. Wertheim, Chicago.

Rock Breakers—
American Hoist & Derrick Co., St. Paul, Minn.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg I. & S. F'dry Co., Pittsburg, Pa.

Roofing (felt)—
Consolidated Roofing Works, Columbus, O.
Empire Paint & Roofing Co., Philadelphia, Pa.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.

Saws—
Peter Gerlach & Co., Cleveland.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
George Place Machine Co., New York City.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Fox Machine Co., Grand Rapids, Mich.
Long & Allstatter Co., Hamilton, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Berger Bros., Philadelphia, Pa.

Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Lodge & Shipley Machine Tool Co., Cincinnati.

Split Collars—
Gouverneur Machine Co., Gouverneur, N. Y.

Stacks—
Wm. B. Scaife & Sons, Pittsburg, Pa.

Stamping and Punching—
Cady Mfg. Co., Cleveland, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago Ill

Steam Packing—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.

Steam Specialties—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
Wm. Jessop & Sons, Ltd., New Yo ,

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.

Steel Tanks—
Wm. B. Scaife & Sons, Pittsburg, Pa.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.
Central Iron & Steel Co., Brazil, Ind.

Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

Telephones—
Union Electric Co., Cleveland, O.
Universal Telephone Co., Indianapolis, Ind.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Gummey, McFarland & Co., Philadelphia, Pa.

Tool Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.
C. H. Besly & Co., Chicago, Ill.

Tube Welding—
S. Fix Sons, Cleveland.

Twist Drills—
Cleveland Twist Drill Co., Cleveland.
C. H. Besly & Co., Chicago, Ill.

Valves—
Ed. Wertheim, Chicago.
C. H. Besly & Co., Chicago, Ill.

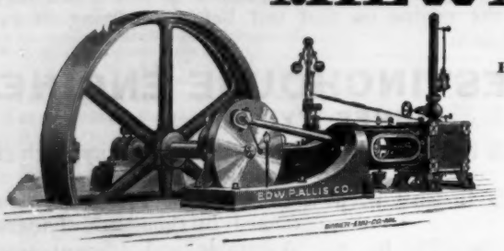
Wheel Barrows—
Akron Cultivator Co., Akron, O.

Wire Nails—
Salem Wire Nail Co., Salem, O.

Wire Rope—
W. A. Crook & Bro's Co., Newark, N. J.
American Hoist & Derrick Co., St. Paul, Minn

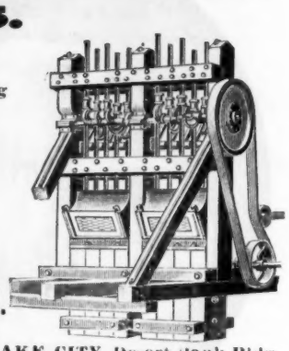
Wire Machinery—
Cady Mfg. Co., Cleveland, O.
John Adt & Son, New Haven Conn.

THE EDWARD P. ALLIS COMPANY
MILWAUKEE, WIS.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting, Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.



REYNOLDS PATENT VERTICAL BOILERS. REYNOLDS CORLISS ENGINES.

NEW YORK, Room 1111, Havemeyer Bldg.
CHICAGO, Room 509, Home Ins. Bldg.
MINNEAPOLIS, Room 416, Corn Exchange.
DENVER, 1316 18th Street.
SAN FRANCISCO, 31 Main Street.
PITTSBURG, 702 German Nat'l Bank Bldg.
SALT LAKE CITY, Desert Bank Bldg
KANSAS CITY, Armour Bldg.

Alphabetical List of Advertisers.

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Write for Estimates on all kinds of Engravings.

CHICAGO HEIGHTS

The Industrial Centre of Chicago

offers Free Factory Sites and other inducements.

If you are seeking a new location it will pay you well to investigate the merits of our proposition

Chicago Heights Land Association

M. H. KILGALLEN, Gen'l Mgr. CHICAGO

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$3.05@ 3.40
No. 1 Bessemer hematite	2.90@ 3.25
Hematites No. 1 non-Bessemer	2.00@ 2.50
No 1. Specular, non-Bessemer	2.35@ 2.75

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$16 00@ 16 25
No. 1 Strong Foundry	13 75@ 14 00
No. 2 Strong Foundry	12 75@ 13 00
No. 1 Gray Forge, red short	12 40@ 12 65
No. 2 Gray Forge, neutral	11 25@ 11 50
No. 1 American Scotch	14 00@ 14 25
No. 2 American Scotch	13 25@ 13 50
Lake Superior Charcoal	13 50@ 14 00
PITTSBURG:	
No. 1 Foundry	$13 50@ 13 75
No. 2 Foundry	12 75@ 13 00
Gray Forge	12 25@ 12 50
White and Mottled	11 50@ 11 75
Warm Blast Charcoal	16 00@ 17 00
Cold Blast Charcoal	22 00@ 26 00
Bessemer	16 50@ 16 75
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	14 00
Local Coke Foundry No. 2	13 50
Local Coke Foundry No. 3	13 00
Local Scotch Foundry No. 1	13 50@ 14 00
Local Scotch Foundry No. 2	13 00@ 13 50
Local Scotch Foundry No. 3	12 50@ 13 00
Southern Coke No. 1	10 70@ 11 00
Southern Coke No. 2	12 50@ 12 75
Southern Coke No. 3	12 25@ 12 50
Southern No. 1 Soft	12 50@ 12 75
Southern No. 2 Soft	12 25@ 12 50
Southern Silveries No. 1	14 00@ 14 50
Southern Silveries No. 2	13 50@ 14 00
Jackson Co. Silveries	15 50@ 16 00
Ohio Silveries No. 1	15 00@ 15 50
Ohio Silveries No. 2	14 50@ 15 00
Ohio Strong Softeners	15 00@ 15 50
Alabama Car Wheel	17 00@ 17 50
Malleable Bessemer	14 50@ 15 00
Coke Bessemer	14 50@ 15 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$12 00@$00 00
Southern Coke No. 2 and No. 1 Soft	11 50@ 00 00
Hanging Rock Coke, No 1	12 50@ 13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	13 50@ 14 50
Jackson County Silvery No 1	14 00@ 15 00
Southern Coke, Gray Forge	11 00
" " Mottled	10 75@ 11 00
Standard Alabama Car Wheel	15 25@ 16 25
Tennessee " "	14 50@ 15 00
Lake Superior " "	15 00@ 15 50

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	GROSS TONS
Old iron rails	$17 50
Old steel rails	14 50
	NET TONS
No. 1 R. R. wrought scrap	$14 00
No. 1 wrought scrap	11 00
No. 1 Machine cast scrap	10 00
Iron axles	18 00
Axle turnings	9 50
Wrought turnings (free from cast)	9 00
Cast borings	8 00
Uncut wrought iron boilers	5 00
Steel boiler plates	10 50
Grate bars	7 50
Pipes and flues (clean)	9 00
Tank iron	10 50
Hoop and band iron	7 00
Sheet iron	8 00
Wrought drillings	8 00
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.70c@1.75c
Angles	1.60c@1.65c
Tees	1.75c@1.85c
Universal Plates	1.75c
Sheared Plates	1.80c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ¾ to 1 inch	1 25
1¼ to 6 by ¾ to 1 inch	1 30
1¾ to 6 by 1⅛ to 2 inch	1 45
1¼ & 1¾ by ⅜ to ¼ inch	1 30
1 & 1⅛ by ⅜ to ¼ inch	1 35
⅛, ¼, ⅜, by ⅜ to ¾ inch	1 45

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.

THE CADY MFG. CO.

18, 20 and 22 Johnson St., CLEVELAND, O.

SEND FOR OUR NEW CATALOGUE OF Power Presses, Drop Hammers, Punches and Shears, Wire Working and Special Machinery.

PERFORATED METALS

OF ALL KINDS FOR

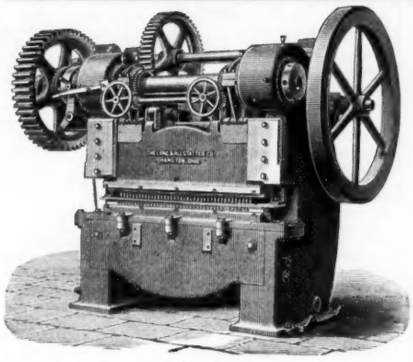
MILLING MINING AND AGRICULTURAL MACHINERY,

PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.

LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.

THE ROBERT AITCHISON. PERFORATED METAL CO.,

OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.



Multiple Punch.

—THE—

Long & Allstatter Co.

HAMILTON, O., U. S. A.

Manufacturers of Belt, Steam and Electrically driven

Power Punches and Shears

for all kinds of Boiler, Tank and Structural Iron Work, Rolling Mills, Locomotive Shops, Car and Wagon Shops, Plow Shops, etc. Send for catalogue.

A. H. LEITCH, PREST. JOHN C. LEITCH, SEC. AND TREAS.

WESTMORELAND FIRE BRICK CO.

MANUFACTURERS OF HIGH GRADE FIRE BRICKS.

PITTSBURG, PA.

Works and Mines, Westmoreland, Pa.

DIXON'S GRAPHITE PAINT

FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL.

Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND, OHIO.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅞ inch	1 25
2 to 2⅜ inch	1 45
2¾ to 3¾ inch	1 40
3⅜ to 4 inch.	1 75
4¼ to 4½ inch	2 35
4¾ to 5 inch	2 55

Oval.

⅜ to 1¼ inch	1 45
⅝ to ¾ inch	1 45
½	1 65
⅜	1 85

Half Oval and Half Round.

1½ to 3 inch	1 80
⅜ to 1½ inch	1 60
⅝ to ¾ inch	1 85
½	2 00
⅞	3 10

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 35
1 to 1⅜ by ¼ and 5-16 inch	1 40
¾ to ⅞ by ¼ and 5-16 inch	1 50
½ to ⅝ by ¼ and 5-16 inch	1 75

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 80
1 7-16 to 2, No. 17, 18 and 19	1 85
1 7-16 to 2, No. 20	1 95
1 7-16 to 2, No. 21	2 05
1 7-16 to 2, No. 22	2 15
1⅛ to 1⅜, No. 13, 14 and 15	1 85
1⅛ to 1⅜, No. 16, 17 and 18	1 90
1⅛ to 1⅜, No 19 and 20	1 95
1⅛ to 1⅜, No. 21	2 05
1⅛ to 1⅜, No. 22	2 15
15-16 and 1 inch, No. 13, 14 and 15	1 80
15-16 and 1 inch, No. 16, 17 and 18	1 95
15-16 and 1 inch, No. 19 and 20	2 05
15-16 and 1 inch, No. 21	2 15
15-16 and 1 inch, No. 22	2 25
⅞, No. 13, 14 and 15	2 05
⅞, No. 16, 17 and 18	2 15
⅞, No. 19 and 20	2 25
⅞, No. 21	2 35
⅞, No. 22	2 45
13-16, No. 13, 14 and 15	2 15
13-16, No. 16, 17 and 18	2 25
13-16, No. 19 and 20	2 35
13-16, No. 21	2 45
13-16, No. 22	2 55
¾, No. 13, 14 and 15	2 25
¾, No. 16, 17 and 18	2 40
¾, No. 19 and 20	2 50
¾, No. 21	2 60
¾, No. 22	2 70
11-16, No. 13, 14 and 15	2 50
11-16, No. 16, 17 and 18	2 55
11-16, No. 19 and 20	2 65
11-16, No. 21	2 75
11-16, No. 22	2 85
11-16, No. 23	2 95
⅝, No. 13, and 15	2 55
⅝, No. 16, 17 and 18	2 65
⅝, No. 19 and 20	2 75
⅝, No. 21	2 85
⅝, No. 22	2 95
⅝, No. 23	3 05
9-16, No. 13, 14 and 15	2 75
9-16, No. 16, 17 and 18	2 85
9-16, No. and 20	2 95
9-16, No. 21	3 05
9-16, No. 22	3 15
9-16, No. 23	3 25
7-16 and ½ inch, No. 13, 14 and 15	2 95
7-16 and ½ inch, No. 16, 17 and 18	3 05
7-16 and ½ inch, No. 19 and 20	3 15
7-16 and ½ inch, No. 21	3 25
7-16 and ½ inch, No. 22	3 35
7-16 and ½ inch, No. 23	3 45
⅜, No. 13, 14 and 15	3 45
⅜, No. 16, 17 and 18	3 55
⅜, No. 19 and 20	3 65
⅜, No. 21	4 96
⅜, No. 22	4 05
⅜, No. 23	4 20

Light Band.

1⅛ to 6 by 1/16 to 3-16 inch	1 55
1¼ to 6 by Nos. 11 and 12	1 60
1 to 1⅜ by 1/16 to 3-16 inch	1 60
1 to 1⅜ by Nos. 11 and 12	1 65
⅞ and 13-16 by 1/16 to 3-16 inch	1 75
⅞ and 13-16 by Nos. 11 and 12	1 80
¾ and 11-16 by 1/16 to 3-16 inch	1 85
¾ and 11-16 by Nos. 11 and 12	1 90
⅝ and 9-16 by 1/16 to 3-16 inch	2 00
⅝ and 9-16 by Nos. 11 and 12	2 05
½ by ⅜ to 3-16 inch	2 15
¼ by Nos. 11 and 12	2 20

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	1 75
⅞ inch, " " " " 13 and 14	1 85
¾ inch, " " " " 11 and 12	1 90
¾ inch, " " " " 13 and 14	1 20

Sheet Iron.

No. 10	1 85
No. 12	1 95
No. 14	2 00
No. 15-17	2 10
No. 18	2 25
No. 20	2 40
No. 22-24	2 50
No. 25-26	2 60
No. 27	2 70

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 80
Shell	1 95
Flange	2 05
Marine Flange	2 40
Fire Box	3 50

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	08
9-16 to ½ in. "	08½

—FOR—

JESSOP'S STEEL Tools, Drills, Dies, etc.

Established over a Century ago. Manufactory, SHEFFIELD, ENGLAND.

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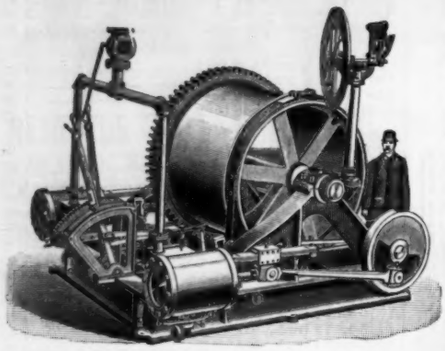
"Medal—World's Columbian Exposition, 1893."

All sizes carried in stock by The W. Bingham Co., Cleveland, Ohio.



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Send for Illustrated Catalogue giving full description, etc. I

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Resists acids and gases arising from inside of FOUNDRIES, IRON WORKS, MILLS, ETC.

Litho-Carbon Paint for Metal Roof sand Sidings Bridges, Smokestacks, etc., covers more space than any other Paint; dries quick, won't crack, peel or blister; will stand a heat of 550° Fahrenheit. Send for 32-page catalogue.

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Wrought Iron Open Hexagonal Turnbuckles,

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Guaranteed Stronger than any Similar Article on the Market.

The Most Satisfactory Fire Brick That Money can Buy

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They have no equal when used for the purpose designated. They are **good, honest, well made** Brick, **made** to hold **your** trade.

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Oak Hill Fire Brick & Coal Co., Manufacturers, OAK HILL, OHIO.

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅜ to 4 in.	.09½
⅜ to 11-16 and 4⅜	.10
⅝ to 6 in.	.10¼
⅝ to 9-32 and 6⅝ to 7 in.	.11
7 in	.13

Flats.

	cts. ℔s.
2 to 9-16 in. wide by 2 to ⅝ thick	.8

Bessemer and O. H. Steel.

Machinery	base price,	1 60
Tire	"	1 70
Spring	"	2 20
Sleigh Shoe	"	2 10
Toe Calk	"	2 15
Cutter Shoes, tapered and bent	"	2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 67
Butt " " "	dis. 57
Lap " galv. "	dis. 55
Butt " " "	dis. 52
Boiler tubes 2¼" and smaller,	dis. 65 and 5
Boiler tubes 2½" and larger	dis. 67½ and 5
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wright's	℔ 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis35
Horton's Universal	dis40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	℔ 3½
Iron, steel points	℔ 1b 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to No. 46 gr.	No. 54 to 150 gr.	Flour, C. F. F.
Kegs, ℔	4½c	5 c	2½c
½ kegs ℔	4¾c	5¼c	2¾c
¼ kegs ℔	5 c	5½c	3 c
10 ℔ cans, 10 in case	6 c	6½c	5 c
10 ℔ cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
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Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

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* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	†12:45 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	† 3:25 pm	† 9:50 am
Hudson and Ravenna	* 5:00 pm	* 8:25 am
Philadelphia and New York	*11:10 pm	* 5:25 am
Baltimore and Washington	*11:10 pm	* 5:25 am
Alliance and Pittsburgh	*11:10 pm	* 5:25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:40 am	* 5:15 pm
Akron and Columbus	* 8:40 am	*5:15 pm
Akron, Columbus & Zanesville	†2:45 pm	†12:10 pm
Akron and Orrville	† 3:25 pm	† 9.50 am
Columbus and Cincinnati	* 8:00 pm	* 6:55 am

Valley Ry.

Depot foot of So. Water St.
City Office 137 Superior St.

	Arrive.	Depart.
Akron & Canton	*6:30 P M	*7:10 A M
Akron, Canton & Valley Jctn.	*10:10 A M	*3:15 P M
Valley Jctn. & Way Stations	†6:30 P M	†7:10 A M
Akron, Canton & Chicago	*8:00 A M	*6:30 P M
Wooster and Chicago	†2:45 P M	†11:00 A M
Wooster		†6:30 P M
Akron, Canton & Marietta	†2:45 P M	†11:00 A M
Steubenville, Wheeling, Washington, D. C., and Baltimore	†2:45 P M	†11:00 A M

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$2.50 CLEVELAND TO BUFFALO

Via "C. & B. LINE,"

Commencing with opening of navigation (about April 1st). Magnificent side-wheel steel steamers

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DAILY TIME TABLE.

SUNDAY INCLUDED.

Lv. Cleveland,	6:00 P.M.	Lv. Buffalo,	6:30 P.M.
Ar. Buffalo,	7:30 A.M.	Ar. Cleveland,	7:30 A.M.

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Take the "C. & B. Line" steamers and enjoy a refreshing night's rest when enroute to **Buffalo, Niagara Falls, Toronto, New York Boston Albany, 1,000 Islands,** or any Eastern or Canadian point.

Cheap Excursions Weekly to Niagara Falls.

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Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	12c
" " " " over 5 lbs	10c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¾	3½
Hexagon	15½	11½	8½	6	5¼	5¼	
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ¶ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 85
Standard Penny Nails, ¶ keg card rate	
{ Car lots	$2.15
{ Less than car lots	$2.35

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ¶ doz	dis 10@10&10

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 50
Medart Pulleys	dis 50
Split Wood Pulleys	dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block	dis 20

Rivets.

Iron, Thousand, list November 1, 1894	dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894	dis 60@65
Copper	dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Apr. 9, 1894

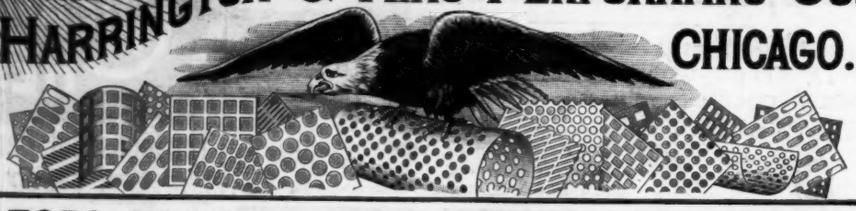
Brass	dis 40
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ¶ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Perforated Filter Press Plates.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.



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For use in GRAIN CLEANING AND MINING MACHINERY, WOOLEN, COTTON, PAPER AND PULP MILLS, RICE, FLOUR AND COTTON SEED OIL MILLS, SUGAR AND MALT HOUSES. DISTILLERIES, FILTER PRESSES. STONE, COAL, AND ORE SCREENS, BRICK AND TILE WORKS, FILTERS, SPARK ARRESTERS, GAS AND WATER WORKS, OIL, GAS AND VAPOR STOVES, COFFEE MACHINERY, ETC.

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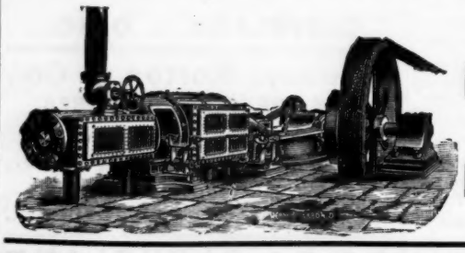
SINGLE, COMPOUND & CONDENSING



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Heavy Special Machinery.

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For Sale or to Rent.

The extensive plant formerly owned and operated by the United Brass Company and the Lorain Manufacturing Company, at Lorain, Ohio.

This plant is located in the city of Lorain, Ohio, a short distance west of Cleveland, where the great Johnson Steel Works, among other manufacturing interests, have been located, and upon one of the best harbors on the lakes. The plant itself is the largest and most complete brass manufacturing plant in the United States and is capable of use as well for manufacturing in iron or steel. The first cost is said to have been in the vicinity of half a million dollars.

The plant consists of a main building of most substantial construction, three stories and attic in height, 385 feet long and 38 feet wide, equipped with the most modern and complete machinery, shafting, engines, etc.

In addition and in connection with this building is a large brass foundry 71 by 143 feet, with core rooms attached, smithy, pattern storehouse, iron foundry 102 by 70 feet, pipe foundry 92 by 98 feet, sand sheds, lumber sheds, sheds for finished stock, carpenter's shop, coal and coke shed, boiler and engine houses, ovens, paint shop, woodworking shop 55 by 93 feet, and all other appurtenances necessary to the equipment of a first-class plant.

The plot upon which this plant is located fronts for about 575 feet on Penfield avenue, the principal thoroughfare in Lorain, and is bounded on the other three sides by Kent, Broad and Forest sts

The facilities for transportation to and from the plant are of the best, shippers having the choice of either the Cleveland, Lorain & Wheeling, or the New York, Chicago & St. Louis ("Nickel Plate") railways, in addition to facilities by water.

The city of Lorain is rapidly improving and increasing in population, and has continued to do so throughout, and notwithstanding, the recent financial depression.

Inspection and correspondence is invited. Either of the undersigned will be pleased to afford further information.

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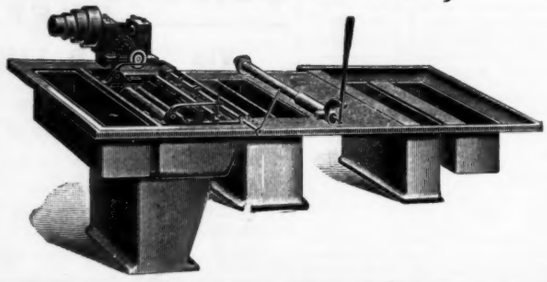

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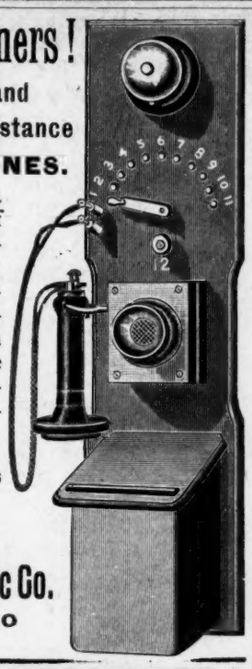

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Cleveland. O

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Hot Blast Pyrometer.—The only stationary Pyrometer now in use durable over 700 degrees.

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MINING HOISTS

—AND—

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BESSEMER AND OPEN-HEARTH STEEL,

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Approved by all Underwriters.

The **FAVORITE Chemical Engines** are positively Non Corrosive and the most powerful on the market. Uses no acid or other harmful chemical; no stored air. Throws stream 50 feet distant. Charged with the most powerful extinguishing fluid ever before placed on the market. Non explosive, from which soda and acid machines are not free. Made in three sizes, 2, 3 and 5 gallon capacity. Copper or Nickle-plated.

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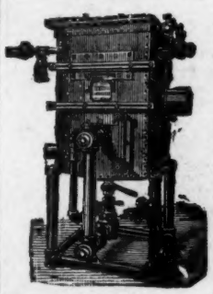

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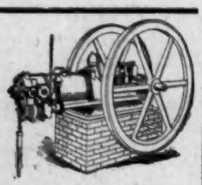

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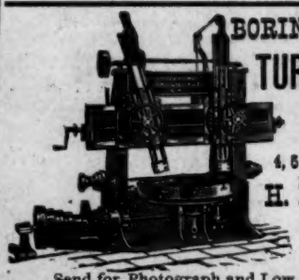

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